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BASIS OF DESIGN FOR FENCE LINE GROUNDWATER EXTRACTION TREATMENT AND DISCHARGE SYSTEM AT SITE 6A SOUTHERN AREA NWIRP CALVERTON NY

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TETRA TECH

Basis of Design Report for Fence Line Groundwater Extraction, Treatment, and Discharge System at Site 6A - Southern Area

Naval Weapons Industrial Reserve Plant Calverton, New York

Mid-Atlantic Division
Naval Facilities Engineering Command

Contract Number N62470-08-D-1001
Contract Task Order WE63

May 2012

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BASIS OF DESIGN REPORT FOR FENCE LINE GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE SYSTEM AT SITE 6A – SOUTHERN AREA

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT (NWIRP) CALVERTON, NEW YORK

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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN)
Contract No. N62470-08-D-1001
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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CFM	cubic feet per minute
CLEAN	Comprehensive Long-Term Environmental Action Navy
CMS	Corrective Measures Study
CTO	Contract Task Order
DCA	1,1-Dichloroethane
DCE	1,1-Dichloroethene
ERP	Environmental Restoration Program
gpm	gallon per minute
GWTP	Groundwater Treatment Plant
HP	horsepower
in-WC	inches water column
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
msl	mean sea level
µg/L	microgram per liter
NAVFAC	Naval Facilities Engineering Command
NWIRP	Naval Weapons Industrial Reserve Plant
NYSDEC	New York State Department of Environmental Conservation
OU5	Operable Unit No. 5
PRAP	Proposed Remediation Action Plan
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SOB	Statement of Basis for Remedy Selection
TCA	1,1,1-Trichloroethane
Tetra Tech	Tetra Tech, Inc.
UIC	Underground Injection Control
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

This Basis of Design Report was prepared to develop and identify the components for a groundwater extraction, treatment, and discharge system (Fence Line Treatment System) for reducing or eliminating the flow of volatile organic compound (VOC)-impacted groundwater migrating from the Site 6A – Fuel Calibration Area to beyond the current facility property line (Fence Line) at Naval Weapons Industrial Reserve Plant (NWIRP) Calverton, Suffolk County, Long Island, New York (Figures 1-1 and 1-2.) This report was prepared by Tetra Tech Inc., (Tetra Tech) for Naval Facilities Engineering Command (NAVFAC) – Mid-Atlantic under the U.S. Navy's Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) WE63. This project is being conducted in accordance with the Navy Environmental Restoration Program (ERP) Operable Unit No. 5 (OU5) Record of Decision (ROD) and the New York State Department of Environmental Conservation (NYSDEC) Resource Conservation and Recovery Act (RCRA) permit number 1-4730-00013/00001-0 Statement of Basis for Remedy Selection (SOB) that is expected to be finalized in May 2012.

1.1 BACKGROUND

The Site 6A-Southern Area Groundwater consists of chlorinated VOC-impacted groundwater that originated at Site 6A – Fuel Calibration Area on NWIRP Calverton property and extends southeast to the Peconic River. The primary site-related chlorinated VOCs consist of 1,1,1-trichloroethane (TCA), 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), and chloroethane. Other VOCs are also present, but at lower concentrations and/or are not detected as frequently. The isoconcentration contour map for DCA is presented in Figure 1-3 and a cross section for the DCA plume is presented in Figure 1-4. DCA is typically the highest concentration VOC detected at each location and represents approximately 62 to 75 percent of the total VOCs in groundwater. Also, the limits of the DCA contours define the extent of other site-related VOC contamination. This data is based on temporary and permanent groundwater sampling events conducted between 1994 and December 2011.

In 2009 and 2010, source area excavations were conducted at Sites 6A - Fuel Calibration Area and 10B – Engine Test House that removed most or all of the petroleum- and solvent-contaminated soil. Groundwater monitoring is currently in progress to determine the effectiveness of the remedial action, and if additional action is required. If the Site 6A and 10B excavations are not effective in mitigating a continuing source of groundwater contamination, the operation of the Fence Line Treatment System identified in this report would be extended. The Operable Unit No. 5 ROD includes a provision for supplemental treatment at the source area(s) that would be addressed under a separate action.

In 2010 and 2011, the Navy conducted a pilot-scale pumping test and a pilot-scale BioStudy in the Fence Line Area to support the development of a Corrective Measures Study (CMS) (Tetra Tech 2011). The results of these studies and supplemental groundwater investigations conducted from April to June 2011 are presented in the March 2012 Data Summary Report, Enhanced Bioremediation Pilot Test (Tetra

Tech, 2012). Because this testing was being conducted in the planned area of the Fenceline Groundwater Treatment System and could interfere with the operation of the planned treatment system, the biostudy testing was ended early.

In March 2011, the Navy presented a CMS that included alternatives for the Southern Area Groundwater. For the evaluation, the CMS divided the plume into five areas including two on-property areas (Source Area and Fence Line Area), and three off-property, downgradient areas (Offsite High Concentration Area, Offsite Low Concentration Area, and Peconic River Area) (Figure 1-5). For the OU5 ROD, the term "Offsite" was deleted from the two off-property area descriptions. In October 2011, the public comment period for the Navy's Proposed Plan, and in November 2011, the public comment period for the NYSDEC RCRA Permit Modification request were initiated. The public comment period for both the Proposed Plan and RCRA Permit Modification request ended on January 17, 2012. The Navy's OU5 ROD and NYSDEC RCRA Permit Modification are being prepared with an estimated completion date in May 2012. These decision documents identify a groundwater extraction, treatment, and discharge system to be installed at the Fence Line Area. A long-term monitoring plan for this system and other portions of the Site 6A-Southern Area Groundwater are being conducted under a separate action.

1.2 OBJECTIVE

The objective of the groundwater extraction, treatment, and discharge system is as follows:

- Reduce or eliminate the migration of VOC-impacted groundwater from Site 6A at the southern boundary of the current NWIRP Calverton property line (Fence Line Area).

1.3 REPORT ORGANIZATION

This report is divided into five sections. Section 1.0 is this introduction. Section 2.0 provided the design basis. The process description is provided in Section 3.0. Permitting requirements are presented in Section 4.0 and the schedule is presented in Section 5.0.

2.0 DESIGN BASIS

This section provides the development of the extraction well capture zone, design of the extraction well network, and development of extracted water quality and treatment goals.

2.1 CAPTURE ZONE DEVELOPMENT

The location of the groundwater extraction well network is based on the isoconcentration contour maps presented in Figures 1-3 and 1-4 and potentiometric surface maps that indicate a southeasterly groundwater flow in this area (Appendix A). Since groundwater flow is to the southeast, the design width of the plume is based on the line perpendicular to the groundwater flow at its approximate center line where the plume crosses the southern property fence line (Fence Line Area).

The VOC-impacted groundwater at the fence line is estimated to be approximately 800 to 1,000 feet wide and 40 feet thick (5 micrograms per liter [µg/L] isoconcentration contour. Variability in the width of the overall plume is based primarily on the estimated northeastern edge of the 5 and 50 µg/L DCA isoconcentration contours. VOC groundwater data in this area is limited and the data is from temporary wells installed in 2008 and 2009 and monitoring wells along River Road. The core of the plume (VOCs greater than 500 µg/L DCA) is approximately 200 feet wide and 10 feet thick. An evaluation of groundwater data collected in 2011 indicates that the axis of the core plume has shifted approximately 100 feet to the west.

2.2 EXTRACTION WELL NETWORK

The design groundwater extraction rate for the containment system is developed using target capture zones, the hydraulic gradient, and the aquifer characteristics. The estimated average width and thickness of the plume in this area are 900 feet and 40 feet, respectively. An evaluation of 2008 to 2011 quarterly water level measurements in the area was used to develop the hydraulic gradient. The hydraulic gradient was measured to vary from 0.002 to 0.004, which appeared to correlate with seasonal precipitation events, and the annual average hydraulic gradient is 0.003. Pumping tests conducted in the Fence Line Area in 2010 were used to develop the aquifer characteristics. The calculated hydraulic conductivity of the aquifer was 186 feet per day (Tetra Tech, 2011). Under these conditions, the average calculated groundwater flow through rate through the Fence Line Area is 104 gallons per minutes (gpm). For design purposes, an average flow rate through the Fence Line Area of 100 gpm will be used.

To account for uncertainty with the groundwater flow through rate, a 40 percent factor will be applied or a potential maximum hydraulic rate of 140 gpm. For design purposes, two extraction wells (EW-01 and -02), approximately 100 feet apart, will pump at a combined rate of 100 to 140 gpm. These wells will be located on the east-west perimeter road and north-south dirt road (Appendix E - Drawing C-3). During operation, if a shift in the plume occurs, the pumping rate from each of the wells can be varied to best intercept the plume. As discussed below, the infiltration galleries will be located side gradient of the extraction wells so as to not interfere with the extraction wells.

A summary of the hydraulic properties is presented in Table 2-1.

Table 2-1 Hydraulic Calculation Summary

Parameter	Value
Plume Width (feet)	900 (800 to 1,000)
Plume Thickness (feet)	40
Hydraulic Conductivity (feet/day)	186
Hydraulic Gradient (foot-V/foot-H)	0.003 (0.002 to 0.004)
Calculated Plume Flow Through Rate (gallons per minute)	104
Design Extraction Rate (Mean/Max) (gallons per minute)	100/140
Number of Extraction Wells	2

2.3 EXTRACTION WELL QUALITY AND TREATMENT GOALS

Estimated groundwater contaminant concentrations are based on monitoring well data and the location of groundwater extraction wells, see Table 2-2. Additional well-specific detail is provided in Appendix A. The DCA plume has been extensively characterized and provides a method for evaluating VOC mass flux rate through the area. The estimated annual average DCA mass flux rate is 22 pounds per year. The DCA mass flux is used as the basis for determining the mean concentration of VOCs to be captured by the Fence Line Treatment System extraction wells.

To estimate the concentration of other VOCs present in the groundwater extraction wells, data from the December 2010 sampling event for monitoring well SA-PZ-138I1 was used (see Appendix A). In this well, DCA represents approximately 63 percent of the total VOCs, and TCA, DCE, and chloroethane represent approximately 15 percent, 3.6 percent, and 18 percent of the total VOCs, respectively. In other areas wells, DCA represents up to approximately 75 percent of the total VOCs, and in several wells, chloroethane is absent. Treatment goals for the site-related VOCs are based on discharge to a Class GA groundwater aquifer, a potential current and future source of potable water and associated goals of New York State Department of Health maximum concentration levels (MCLs). The highest of July, October, and December 2010 data from monitoring well SA-PZ-138I1 is also used as the design basis for the maximum concentration of VOCs in the groundwater extraction wells.

Iron and manganese are also naturally present in site groundwater. The Site 6A-Southern Area includes a series of wetland and subsurface peat formations, which allow the formation of reduced pH and anaerobic conditions in the groundwater. Under these conditions, iron, manganese, and arsenic naturally found in site soils can become soluble. In the Fence Line Area, iron concentrations in the groundwater range from approximately 200 µg/L to 3,300 µg/L and manganese concentrations range from approximately 200 µg/L to 7,900 µg/L. Near the Peconic River, the ultimate discharge point for site groundwater, natural iron and manganese concentrations are approximately 13,700 µg/L and 185 µg/L, respectively (Tetra Tech, 2011).

During the pumping test conducted in the Fence Line Area in 2010, iron and manganese concentrations in the extracted groundwater were approximately 750 µg/L and 1,300 µg/L, respectively (Tetra Tech 2011). The higher iron and manganese concentrations are generally in the areas of higher VOC concentrations, but a direct correlation between these metals and VOCs is not apparent. For design purposes, the average iron and manganese concentrations of approximately 1,200 to 1,500 µg/L will be used, respectively. At these concentrations, if the iron and manganese are allowed to oxidize and precipitate in the treatment system, some interference (silting and plugging) to the treatment units and infiltration galleries/injection wells would be anticipated. The maximum average and manganese concentrations are assumed to be twice the average concentrations. Because iron and manganese is naturally present in the groundwater and is present at higher concentrations in downgradient groundwater, the design assumes that there will be no discharge requirements for soluble iron and manganese.

The groundwater extraction, treatment, and discharge system is intended to operate until the mass of VOCs leaving the NWIRP facility property line has been eliminated or significantly reduced. The treatment duration will be in part based on the effectiveness of the 2009/2010 Source Area remedial actions in reducing or eliminating a continuing source of contamination, the groundwater seepage velocity, VOC retardation on soils, and biodegradation. Based on these factors, the treatment system is estimated to operate for two to eight years, with a geometric mean estimate of four years.

Shutdown criteria for the treatment system are as follows:

- The concentration of individual site-related chlorinated VOCs entering the treatment system extraction wells is less than 10 µg/L and the maximum concentration of individual site-related chlorinated VOCs in fence line monitoring wells is less than 50 µg/L. This condition corresponds to an approximate 90 percent reduction in total VOCs and 95 percent reduction in individual VOCs leaving the property over current conditions.

TABLE 2-1
DESIGN BASIS
FENCE LINE GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE SYSTEM
NWIRP CALVERTON, NEW YORK

Design Parameter	Daily Maximum or Range	Annual Mean	Treatment Goal
Design Flow rate, gpm	100 to 140	100	---
Temperature, C	8 to 15	11	---
pH, S.U.	5.5 to 6.5	6.5	5.5 to 9.0
Constituents (µg/L)			
Iron	200 to 2,400	1,200	---
Manganese	200 to 3,000	1,500	---
1,1,1-Trichloroethane	260	11	5
1,1-Dichloroethane	1,100	51	5
1,1-Dichloroethene	65	3	5
Chloroethane	320	13	5
Benzene	4.4	0.2	5
1,4-Dichlorobenzene	16	1	5
1,3-Dichlorobenzene	4	0.2	5
1,2-Dichlorobenzene	6.4	0.3	5
Isopropylbenzene	11	0.4	5
1,2,4-Trichlorobenzene	14	1	5
Total VOC	1,801	80	---
Organic Loading	(pounds/day)	(pounds/year)	
DCA Mass Flux Rate	1.3	22	---
Total VOC Mass Flux Rate	2.2	35	---

--- No value or goal.
µg/L – micrograms per liter.
VOC – volatile organic compound.
DCA – 1,1-dichloroethane.
gpm – gallons per minute.
S.U. – Standard Unit.
C – Celsius.

3.0 PROCESS DESCRIPTION

This section describes the processes that will be used for the treatment of groundwater at the site and presents the design basis for these processes.

3.1 GENERAL DESCRIPTION

The Groundwater Treatment Plant (GWTP) consists of extraction wells, a treatment system, and a discharge system that will be located adjacent to the southern property line. A GWTP building will be located on the perimeter road, north of the intersection of Grumman Boulevard and River Road and near the middle of the groundwater extraction network. See Drawings G-0 and C-1 (Appendix E) for GWTP location and site layout plans. The treatment system will consist of air stripping and pressure filtration, and will be housed in a pre-fabricated metal building. The groundwater extraction system will consist of two recovery wells, and the treated effluent will be returned to the aquifer via two infiltration galleries with injection wells.

3.2 GWTP SYSTEM OVERVIEW

The process flow diagram is presented on Drawing PFD (Appendix E). Design flow rates and stream-specific VOC concentrations through the groundwater treatment processes are also presented. VOC-contaminated groundwater will be pumped from the two groundwater extraction wells CA-FL-EW-01 and -02 (EW-01 and -02) to the top of the tray air stripper AS-200 using two self-priming horizontal extraction pumps P-110 and P-120. In the tray air stripper, the VOCs will be removed from the groundwater by a countercurrent flow of air from blower B-200 and be transferred to the vapor phase. Based on a comparison of annual and maximum loadings of VOCs with annual and short-term NYSDEC DAR-1 analysis, off-gas treatment will not be required (See Appendix B).

Groundwater will cascade down the air stripper trays and will collect at the bottom of the air stripper in a sump that is integral to the air stripper equipment. Horizontal centrifugal pumps P-210 and -220 will transfer the treated water from the air stripper to dual 25-micron cartridge pressure filters PF-310 and -320, for removal of precipitates (oxidized iron). The filtered water will be discharged to infiltration galleries and injection wells CA-FL-IW-01 and -02 (IW-01 and -02).

The iron and manganese in the raw groundwater are in a soluble, reduced oxidation state (ferrous iron and divalent manganese) consistent with the anaerobic condition and reduced pH characteristic of site groundwater. The rate of oxidation of iron and manganese is a function of pH of the process water. The optimal pH for the oxidation for iron is greater than 7.5 SU iron and for manganese is greater than 9.5 SU. Therefore, air stripping may result in some oxidation of iron from the ferrous to the ferric state and subsequent precipitation as iron hydroxide, but minimal oxidation of manganese should occur.

To minimize the formation of iron hydroxide precipitates, a polyphosphate will be metered into the incoming groundwater to sequester the soluble iron. The effectiveness of the metal sequestering in completely preventing precipitate formation is uncertain.

During operation of the GWTP, quarterly cleaning of the air stripper trays, monthly changeout of the cartridge filters, and annual cleaning of the infiltration galleries/injection wells are assumed. The air stripper will be designed to allow access to the trays and the infiltration gallery and injection wells will also be equipped with cleanouts. Any water that is collected in the building sump will be filtered and treated in the air stripper.

3.3 DESIGN FLOW AND INFLUENT CONCENTRATIONS

The groundwater treatment system is designed to process an average flow of 100 gpm and a maximum flow of 140 gpm. Table 3-1 summarizes the design influent and effluent concentrations and serves as the basis for design of the treatment system. The Maximum Influent Design concentrations are potential short-term (e.g., 1 to 3 months) conditions that may occur during startup. The maximum flow rate at this time would be 70 to 100 gpm and the system must achieve the Maximum Design Effluent Criteria. Over the long-term, the VOC concentrations are anticipated to decrease to the Mean Design Influent concentrations. At that time, the system flow rate may be increased to 140 gpm, and the system must achieve the Mean Design Effluent Criteria.

Table 3-1 Design Parameters

Parameter	Design Influent Conditions		Design Effluent Criteria	
	Maximum	Mean	Maximum	Mean
Temperature, C	11	11	NA	NA
pH	6	6	NA	NA
Iron Total, µg/L	2,400	1,200	NA	NA
Manganese Total, µg/L	3,000	1,500	NA	NA
1,1,1-Trichloroethane, µg/L	260	11	2.5	1
1,1-Dichloroethane, µg/L	1,100	51	2.5	1
1,1-Dichloroethene, µg/L	65	3	2.5	1
Chloroethane, µg/L	320	13	2.5	1
Benzene, µg/L	4.4	0.2	2.5	1
1,4-Dichlorobenzene, µg/L	16	1	2.5	1
1,3-Dichlorobenzene, µg/L	4	0.2	2.5	1
1,2-Dichlorobenzene, µg/L	6.4	0.3	2.5	1
Isopropyl Benzene, µg/L	11	0.4	2.5	1
1,2,4-Trichlorobenzene, µg/L	14	1	2.5	1
Total Target VOC, µg/L	1,801	80	NA	NA

NA – Not Applicable

3.4 GROUNDWATER EXTRACTION SYSTEM

The groundwater extraction system consists of two 10-inch stainless steel casing extraction wells, CA-FL-EW-01 and -02, with 20-foot long, 30-slot (0.030 inch) stainless steel high flow screens and an approximate 14 by 20 US Sieve gravel pack. During installation of the wells, a pilot hole will be drilled, and the based on grain-size analysis of the formation material, the gravel pack design may be modified. The bottom of the well screens will be set to the top of the clay unit present at approximately 45 to 50 feet bgs. The wells will be completed with a bentonite seal, and bentonite/cement grout, and a stickup protective casing.

Low level switches will be provided in the wells to protect the extraction well pumps. The two wells, approximately 100 feet apart, will each be used to extract 50 to 100 gpm of groundwater. These wells will be located on the east-west perimeter road and north-south dirt road (Appendix E - Drawings C-2 and C-3). During operation, if a shift in the plume occurs, the pumping rate from each of the wells can be varied to optimally intercept the plume. Groundwater is present at a depth of approximately 1 to 4 feet bgs (34 to 36 feet mean sea level [MSL]). During operation, the water level within the wells will drop 4 to 6 feet (approximately 28 to 32 feet MSL). The piping within and from the extraction well will be carbon steel and then schedule 80 polyvinyl chloride (PVC). The piping will be sloped toward the extraction wells to prevent the buildup of gases within the piping. The ground surface over the transfer piping may be mounded to minimize trench excavation depth and maintain 3.5 feet of soil cover for freeze protection. The suction down pipe in the well will extend 20 feet below the static water table.

The groundwater will be extracted using a horizontal self-priming centrifugal pump (P-110) and inline spare (P-120), located within the treatment building (pump suction elevation of 40.5 feet MSL) (PID-1). Each pump will be capable of providing an operating lift of 18 feet (12.5 vertical feet plus an additional 5.5 feet to account for pressure drops within the suction piping). During startup, the static lift would be approximately 6.5 feet. Priming water will be available at the plant to assist with startup or after an extended shutdown. Operation of the pump will be on-off-auto. Normal operation will be in the auto mode, with the following interlocks:

- HOA P-110 and -120 (Hand-Off-Auto pump start, with push button start in Auto mode [overrides FSL-110], and pump selector switch)
- LSL-110 and LSL-120 (low-low level in the extraction wells, shuts down GWTP, alarm, manual restart) (20.5 feet MSL)
- FSL-110 (low flow at pump P-110/120 discharge, shuts down GWTP, alarm, manual restart) (15 gpm)
- B-200 (blower operation, starter interlock, blower must be running to operate P-110/120)

Within the treatment building, the suction piping will be plumbed so that groundwater can be extracted from both wells simultaneously by a single pump at a maximum combined flow rate of 100 gpm. Pumps P-110 and P-120 will be horizontal centrifugal self-priming configuration, with a 5 horsepower (HP), 460 volt, 3-phase motor. The pumps will discharge to the top of the air stripping system. Full-port ball-valves will be provided on the suction piping of the pumps, the pressure drop across these valves will be minimal when the valves are fully open, and these valves will be primarily used as isolation valves, but will also provide minimal control for balancing the flow between the two extraction wells. Flow meter FM-110 will be used to monitor flow rates and shut down the system in the event of insufficient or no water flow. Manual Flow Control Valve (FCV-110) will be used to control the system flow rate.

3.5 AIR STRIPPING SYSTEM

The air stripper AS-200 will be of the tray-type unit, capable of effectively treating 100 gpm of groundwater at the maximum groundwater contaminant concentrations to achieve effluent concentrations equal to 50 percent of MCLs (PFD and PID-2). This unit will also be sized to provide a maximum hydraulic capacity of 140 gpm, but at reduced VOC concentrations in the groundwater. The air stripper (AS-200), the blower (B-200), and the effluent/injection pumps (P-210 and -220) will be mounted on a single skid. The treated groundwater that passes through the air stripper trays will collect in a sump (minimum 250 gallons) that is integral to the air stripper and will be subsequently pumped out. The water level in the air stripper sump will be used to control the horizontal centrifugal pumps P-210 and P-220, with variable frequency drive, 5.0 HP, 460 volts, 3-phase motors. One of these pumps will normally operate and the second pump will serve as an inline spare. Normal operation will be in the auto mode, with the following interlocks:

- HOA P-210 and -220 (Hand-Off-Auto pump start, with push button start in Auto mode and A/B selector switch)
- LSL-200 and LSH-200 (start and stop P-210 or -220)
- LSLL-200 and LSHH -200 (low-low or high-high level shut down the GWTP, alarm, manual restart)
- LC-200 (controls the frequency on P-210 or -220 drive units, operation based on level in the air stripper sump (corresponding minimum flow rate of 15 gpm and maximum flow rate of 150 gpm)

The air stripper blower B-200 will be a centrifugal-type with 7.5 HP, 460 volts, 3–phase motor. The blower will be equipped with an inlet silencer and filter. The blower will be capable of producing approximately 900 cubic feet per minute (CFM). The final speed rates will be determined during blower selection based on achieved short-term and long-term VOC removal goals. The blower discharge pressure will be monitored by high and low pressure switches and the flow rate will be monitored by a mass flow meter. This flow measurement will be transmitted to the control panel.   The air stripper, blower, injection wells and associated controls will be a package system.

Normal operation will be in the auto mode, with the following interlocks:

- HOA-B200 (Hand-Off-Auto, with push button start in Auto mode[overrides PSL 200])

- PSL 200 and PSH 200 (low pressure and high pressure switches on B-200, shut down the GWTP, alarm, manual restart) (2 inches and 10 inches water column [in-wc])

3.6 PRESSURE FILTER SYSTEM

The water from the air stripper sump will be pumped through two parallel bag filter vessels (PF-310 and -320) and then injected into the aquifer via two infiltration gallery-injection well combination (PID-3). The bag filters will be sized for 25 microns and will be pleated to maximize the dirt holding capacity of the filter bags. The bag filters are sized based on solids loading and a bag change out frequency of once per month or less. The differential pressure across the multi-bag filter vessels will be automatically monitored using a differential pressure switch. When a high differential pressure is indicated (e.g., 15 PSI), the operator will be notified by an alarm and the GWTP will be shutdown in order to replace the spent bag filters. Based on an influent iron concentration of 1,200 µg/L and assuming all the soluble iron is converted and removed as iron hydroxide following oxidation, it is estimated that the bag filters have to be replaced every four weeks. As previously discussed, polyphosphates will be used to minimize iron oxidation and precipitation and less frequent change outs are anticipated. PF-310 and -320 operate as flow through units. Normal operation will be in the auto mode, with the following interlocks:

- PDSH-300 (Particulate Filter PF-310 and -320) high differential pressure, shut down the GWTP, alarm, manual restart) (15 PSI)

3.7 DISCHARGE SYSTEM

Treated groundwater will be discharged to one or both injection systems located approximately 500 feet east and west of the groundwater extraction wells (Appendix E - Drawing C-3). The injection systems will consist of dual 200-foot perforated pipe installed within a gravel bed and a 50-foot vertical injection well. Each system will normally be capable of discharging 100 gpm of treated groundwater. The injection wells will be equipped with a high level switch to indicate potential fouling of the injection piping and/or seepage of treated groundwater to the surface (PID-3). The ground surface over the transfer piping may be mounded to minimize trench excavation depth and maintain 3.5 feet cover depth. Normal operation will consist of the following interlock:

- LSH –IW1 and –IW2 (high-high level in injection wells shuts down GWTP, alarm, manual restart) (38 feet MSL)

3.8 MISCELLANEOUS SYSTEMS

<u>Building Sump:</u> A 30-gallon sump and submersible pump (P-500) will be provided for the facility that will transfer any water that collects in the sump to the air stripper influent line. The submersible pump with be rated at 10 gpm at 15 feet TDH, with a ½ HP, 120 volts, single phase motor, and integral float switch will be provided. The pump discharge will be equipped with a filter to control the discharge of solids to the

air stripper. The sump will be provided with a high-level switch which will shut down the treatment plant in the event of a sump high level condition. Normal operation is in auto mode, with the following interlock:

- LSHH-500 (high-high level in sump, shut down the GWTP, alarm, manual restart)

Polyphosphate System: Polyphosphate will be injected to the incoming groundwater to sequester the soluble iron and minimize precipitation in the air stripper and reinjection systems. Approximately 2 milligrams per liter (mg/l) of the polyphosphate will be used to keep the iron and manganese sequestered. For a nominal treatment plant flow rate of 100 gpm, a dosage of 2 mg/L translates to a usage of 1.4 gallons per day (4 milliliters per minute) for a polyphosphate with a specific gravity of 1.39. Therefore, a 55-gallon drum of polyphosphate will last approximately 40 days. The quantity to be stored on-site can be decided based on usage during start-up (currently anticipated to be 4 drums). The drums will be stored on a spill pallet. The polyphosphate will be dosed with a diaphragm metering pump capable of a flow rate of up to 5 gallon per day (15 milliliter per minute), two pumps will be provided (P-510) of which one will be a shelf spare. The polyphosphate will be fed into the 3-inch air stripper feed line through an injection quill and static mixer setup. Operation of the pump will be interlocked with operation of the groundwater extraction pump.

Priming System: The treatment plant utilizes self-priming pumps to transfer groundwater from the recovery wells to the air stripper. A 175-gallon polyethylene tank will be provided to store water which can be used to prime the suction lines in the event of an extended pump shutdown or loss of pump prime.

3.9 PLANT LAYOUT

The layout plan for the GWTP is shown on Appendix E - Drawing M-1. The groundwater influent pipes from the recovery wells enter the GWTP building through the floor in the northwest corner. The groundwater is then pumped to the top of the shallow tray air stripper from where it is pumped through bag filters and ultimately back into the aquifer. The extraction well pumps, air stripper, and bag filters will be located on the north side of the building. The building will be provided with a sump and submersible pump. The polyphosphate feed system will be located adjacent to the extraction well pumps and the air stripper.

3.10 INSTRUMENTATION AND CONTROL

The components of the groundwater treatment system will be monitored by appropriate instrumentation. The system will be equipped with flow meters, pressure indicators, differential pressure transmitters and pressure and level switches. The pumps and blower will be monitored by local pressure indicators and pressure switches. The bag filters will be equipped with local pressure indicators and a differential pressure transmitter. The differential pressure transmitters will include a high pressure cutoff. A flow meter will be provided on the influent line to monitor and record the volume and flow rate of groundwater being processed through the plant. The entire system will be monitored by a PLC-auto-dialer system.

The auto-dialer will be set to call out numbers based on a set hierarchy and for the following alarm conditions:

- Extraction Well Low Level
- Extraction Well Pump Low Flow
- Blower Low or High Pressure
- Bag Filter High Differential Pressure
- Air Stripper Sump Low and High Level
- Building Sump High Level
- Injection System High Level

In each of the above cases the system will be shut down and the auto-dialer will be activated.

The alarm has to be acknowledged at the control panel located at the building prior to restarting the system. The system is designed to be operated on a long-term basis as an unmanned operation equipped with an auto dialer. The system will operate as follows:

1. The water level in the extraction and injection wells will be monitored by a level element.
2. The extraction well flows will be monitored by a flow meter.
3. The air stripper unit will be skid mounted and is provided with the stripper trays, a blower, and injection pumps (with variable frequency drives), and control panel. Injection well pumps will be controlled by the water level in the air stripper sump.
4. Treated water will be pumped through particulate filters that are provided with a differential pressure indicator and transmitter.
5. In the event of an alarm condition or plant shutdown, the auto dialer will dial an on-call operator.
6. The following interlocks will be provided:
    - Influent pumps do not turn on prior to startup of the air stripper blower.
7. In the event of a blower failure, the entire system will be shutdown.

Local control panels will be provided with MAN-OFF-AUTO switches for the pumps and blower. The pumps and blowers can be run locally by setting and holding the switch in the MAN position. In the AUTO mode, push button start buttons will be used.

3.11 TREATMENT BUILDING DESCRIPTION

The treatment system equipment will be housed in a pre-fabricated building. Soil data for the foundation design is provided in Appendix D. The GWTP will be housed in a 35-foot long x 25-foot wide x 14-foot tall metal building. The east side of the building is equipped with an 8-foot wide overhead (roll-up) door and a 3-foot wide by 7-foot tall utility door.   An electrical transformer installed in a vault will also be located outside the building – on the northwest corner. The building will be provided with lighting, security system, work space, telemetry system, electric heaters and vent fans. Equipment will be installed on a pad, and the building will be provided with a sump. The building floor will be sloped towards the sump. The building will be provided with a fire and burglary control panel. In the event of a break-in, the auto dialer will be activated.

3.12 MONITORING WELL PROGRAM

A monitoring well program to evaluate extraction well capture zones and groundwater cleanup will be prepared under separate cover. This program will evaluate the existing monitoring well network and the need to install additional monitoring wells, as well the frequency of testing and parameters to be monitored (e.g., water levels and VOC concentrations)

4.0 PERMITING REQUIREMENTS

The Navy will contact the NYSDEC and United States Environmental Protection Agency regarding permitting submittals. Since the work is being conducted on federal government property under CERCLA authority, permits are not required. Anticipated specific submittals and reporting activities are anticipated to consist of the following.

- Notifications to NYSDEC that construction is being conducted in the area of wetlands and the Peconic River.
- Notifications to NYSDEC that groundwater extraction and discharge activities will be conducted.
- Notification to NYSDEC that off gas containing VOCs will be discharged to the atmosphere.
- Notification to the United States Environmental Protection Agency (USEPA) that treated groundwater will be discharged under an Underground Injection Control (UIC) program.

5.0 SCHEDULE

The estimated construction and startup schedule is dependent on finalizing the Navy's ROD and the NYSDEC RCRA Permit by April 30, 2012.

Activity	Schedule
Finalize Design	April 30, 2012
Solicit Bids	May 11, 2012
Award Contract	June 30, 2012
Planning Documents	July 30, 2012
Construction	November 30, 2012
Complete Start up	December 30, 2012

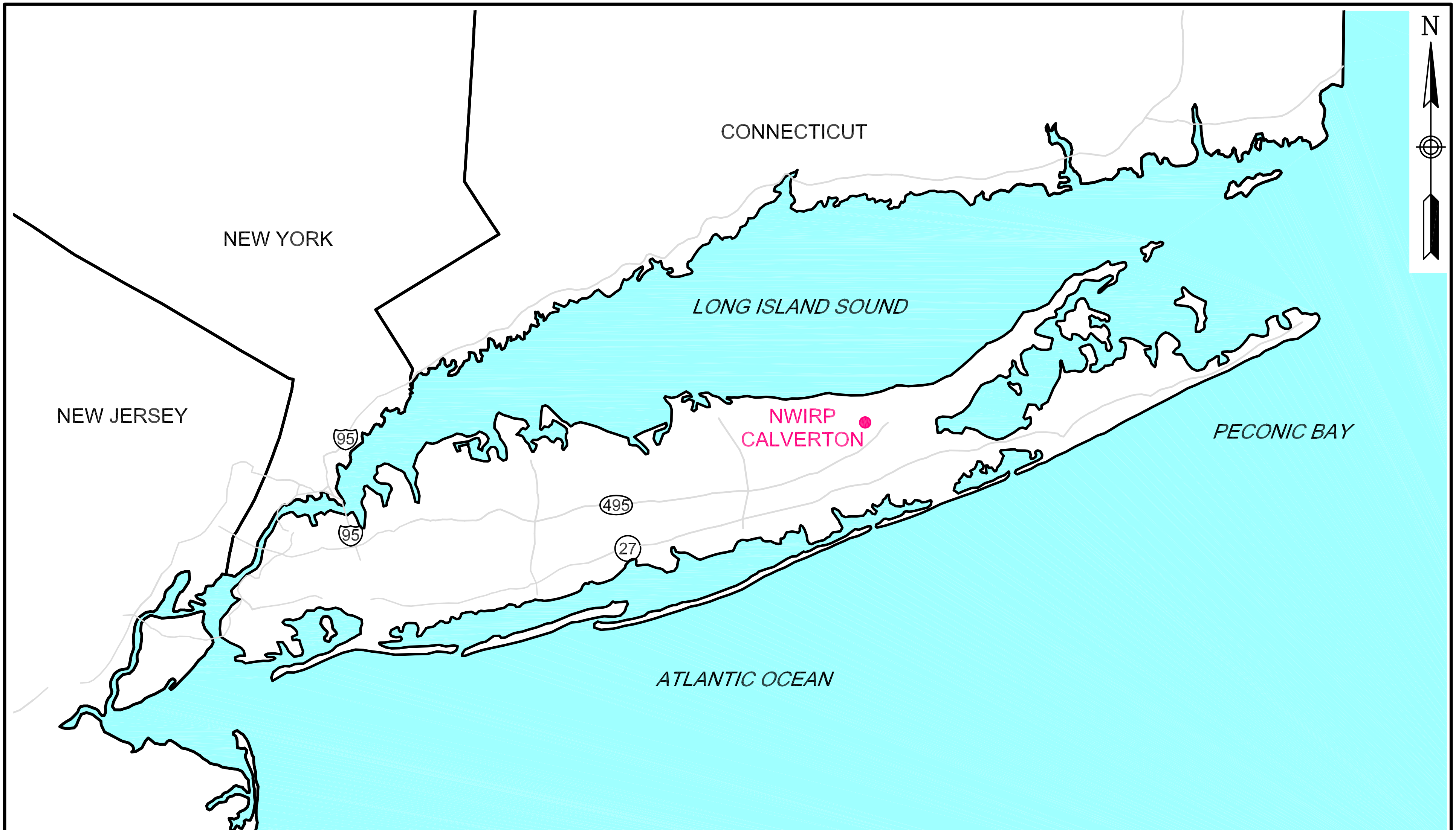
REFERENCES

Tetra Tech, 2011. Corrective Measures Study (CMS)/Feasibility Study for Southern Area Groundwater Plume, prepared by Tetra Tech Inc. for Mid-Atlantic Division Naval Facilities Engineering Command, under Contract Number N62470-08-D-1001, Contract Task Order WE-08, March.

Tetra Tech, 2012. Data Summary Report, Enhanced In Situ Bioremediation Pilot Test, Southern Area prepared by Tetra Tech Inc. for Mid-Atlantic Division Naval Facilities Engineering Command, under Contract Number N62470-08-D-1001, Contract Task Order WE-08, March.

FIGURES

112G02045\0510\112G02045CM05.DWG 03/10/10 MKB



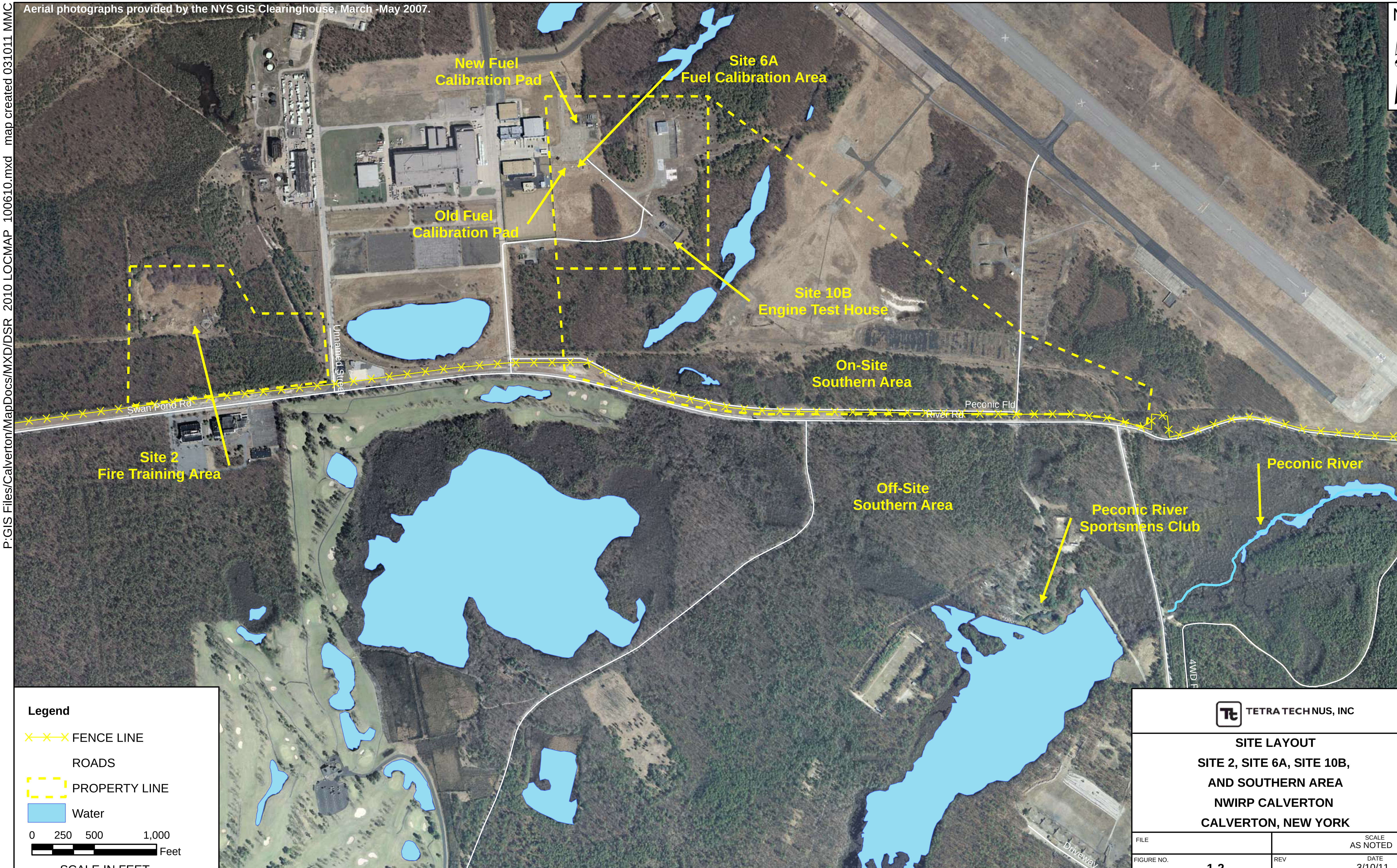
0 15 30

SCALE IN MILES

TETRA TECH NUS, INC.

GENERAL LOCATION MAP
NWIRP CALVERTON
CALVERTON, NEW YORK

SCALE NOT TO SCALE	
FILE 112G02045CM05	
REV 0	DATE 03/10/11
FIGURE NUMBER FIGURE 1–1	



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TETRA TECH NUS, INC

SITE LAYOUT
SITE 2, SITE 6A, SITE 10B,
AND SOUTHERN AREA
NWIRP CALVERTON
CALVERTON, NEW YORK

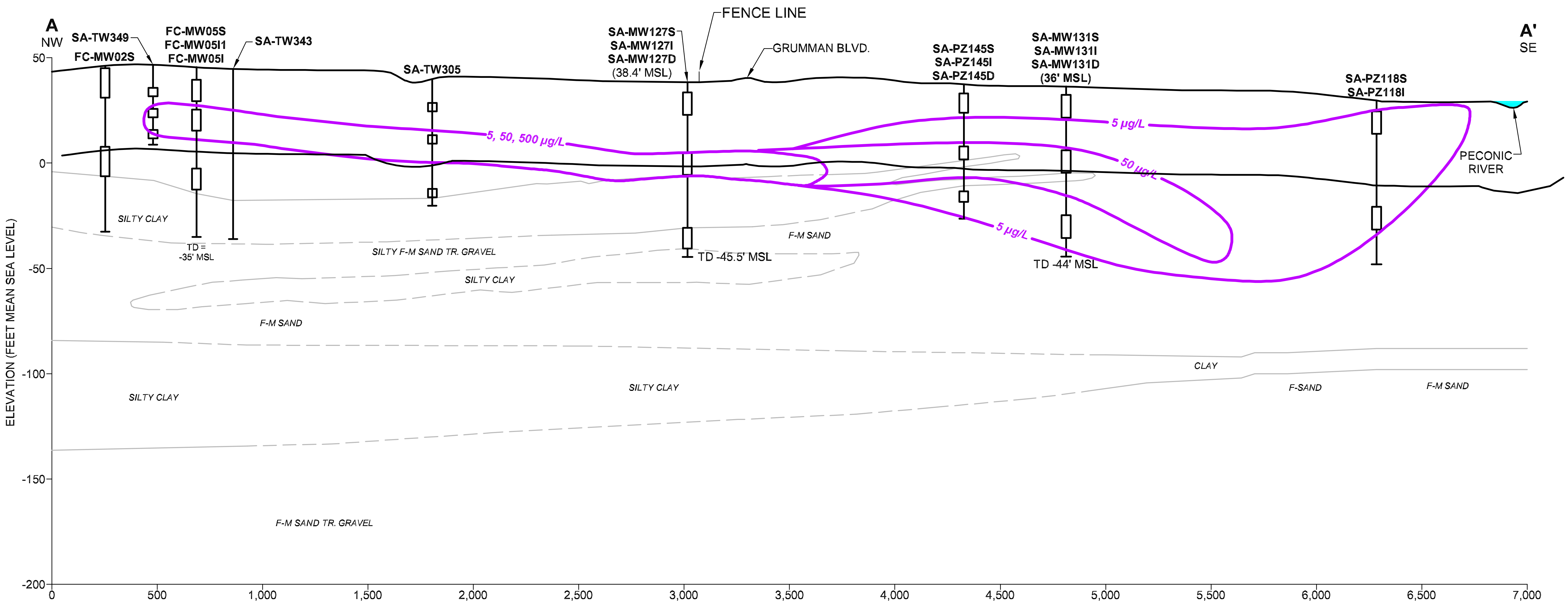
FILE	SCALE AS NOTED
FIGURE NO. 1-2	REV	DATE 3/10/11

TETRA TECH NUS, INC.

SOUTHERN AREA
GROUNDWATER DCA ISOCONCENTRATION
CONTOUR MAP
NWIRP CALVERTON
CALVERTON, NEW YORK

FILE	SCALE	
112G01655GM35	AS NOTED	
FIGURE NUMBER	REV	DATE
FIGURE 1–3	0	03/17/12

112G01655\0510\112G01655GX05.DWG 03/19/12 MKB



LEGEND

(45.5' MSL)	GROUND SURFACE ELEVATION (FEET MEAN SEA LEVEL)
	GROUND SURFACE
SA-MW131S	MONITORING WELL SCREEN
F SAND	LITHOLOGY
5 µg/L	1,1-DICHLOROETHANE ISOCONCENTRATION CONTOURS (5, 50, 500 µg/L)
	CONFINING UNIT
TD -35' MSL	TOTAL DEPTH (FEET MEAN SEA LEVEL)
µg/L	MICROGRAMS PER LITER

0 500 1,000

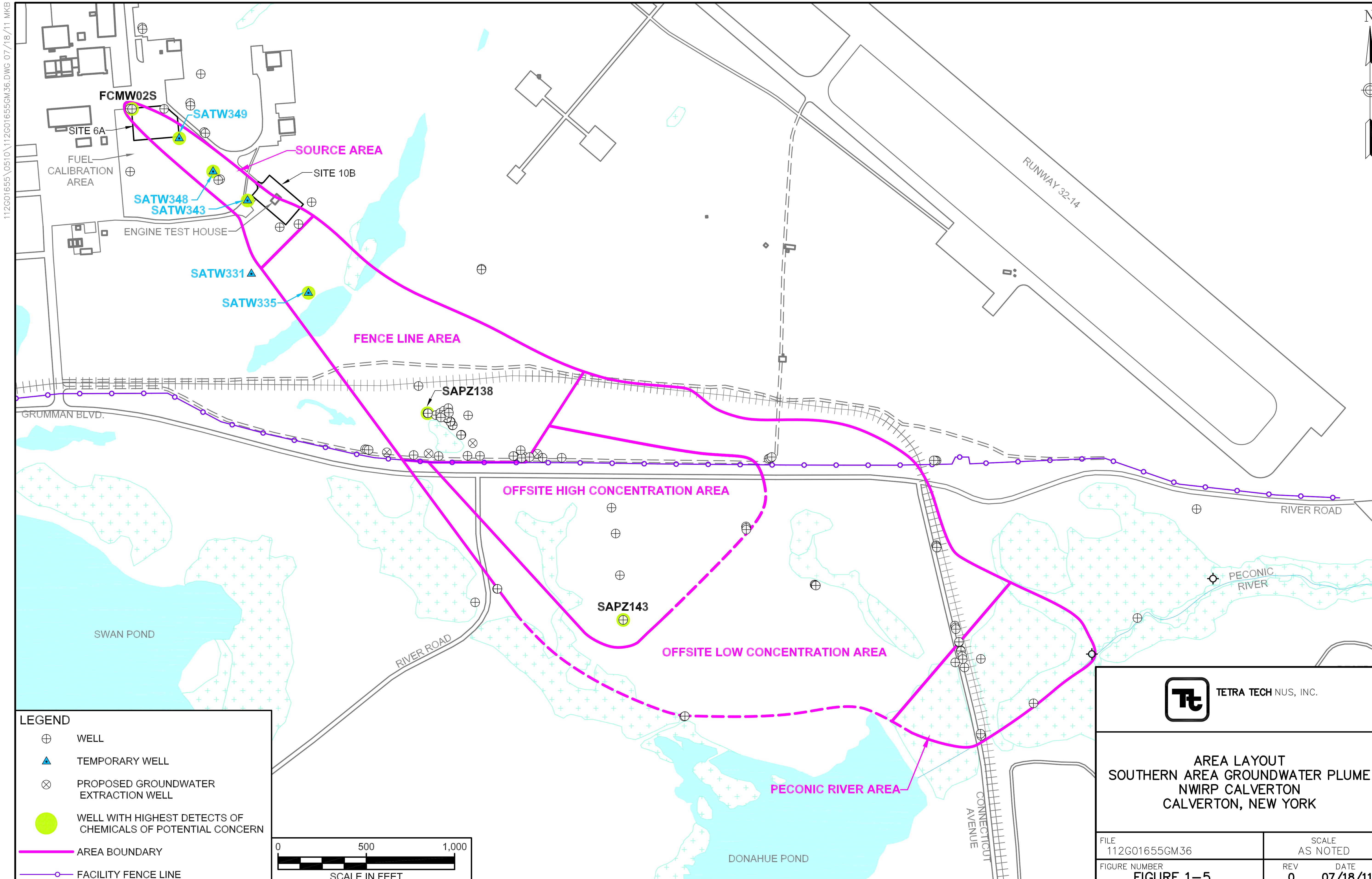
SCALE IN FEET

TETRA TECH NUS, INC.

1,1–DICHLOROETHANE ISOCONCENTRATION CONTOUR MAP FOR GEOLOGIC CROSS–SECTION A – A' NWIRP CALVERTON CALVERTON, NEW YORK

FILE	SCALE
112G01655GX05	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 1–4	0	03/19/12


112G01655\0510\112G01655GM36.DWG 07/18/11 MKB
N
FCMW02S
SATW349
SITE 6A
SOURCE AREA
FUEL CALIBRATION AREA
SITE 10B
SATW348
SATW343
ENGINE TEST HOUSE
SATW331
SATW335
FENCE LINE AREA
RUNWAY 32-14
SAPZ138
GRUMMAN BLVD.
OFFSITE HIGH CONCENTRATION AREA
RIVER ROAD
PECONIC RIVER
SWAN POND
RIVER ROAD
SAPZ143
OFFSITE LOW CONCENTRATION AREA
PECONIC RIVER AREA
CONNECTICUT AVENUE
DONAHUE POND
LEGEND
WELL
TEMPORARY WELL
PROPOSED GROUNDWATER EXTRACTION WELL
WELL WITH HIGHEST DETECTS OF CHEMICALS OF POTENTIAL CONCERN
AREA BOUNDARY
FACILITY FENCE LINE
0
500
1,000
SCALE IN FEET
TETRA TECH NUS, INC.
AREA LAYOUT
SOUTHERN AREA GROUNDWATER PLUME
NWIRP CALVERTON
CALVERTON, NEW YORK
FILE
112G01655GM36
SCALE
AS NOTED
FIGURE NUMBER
FIGURE 1–5
REV
0
DATE
07/18/11

APPENDIX A

BACKUP ANALYTICAL DATA AND POTENTIOMETRIC SURFACE MAPS

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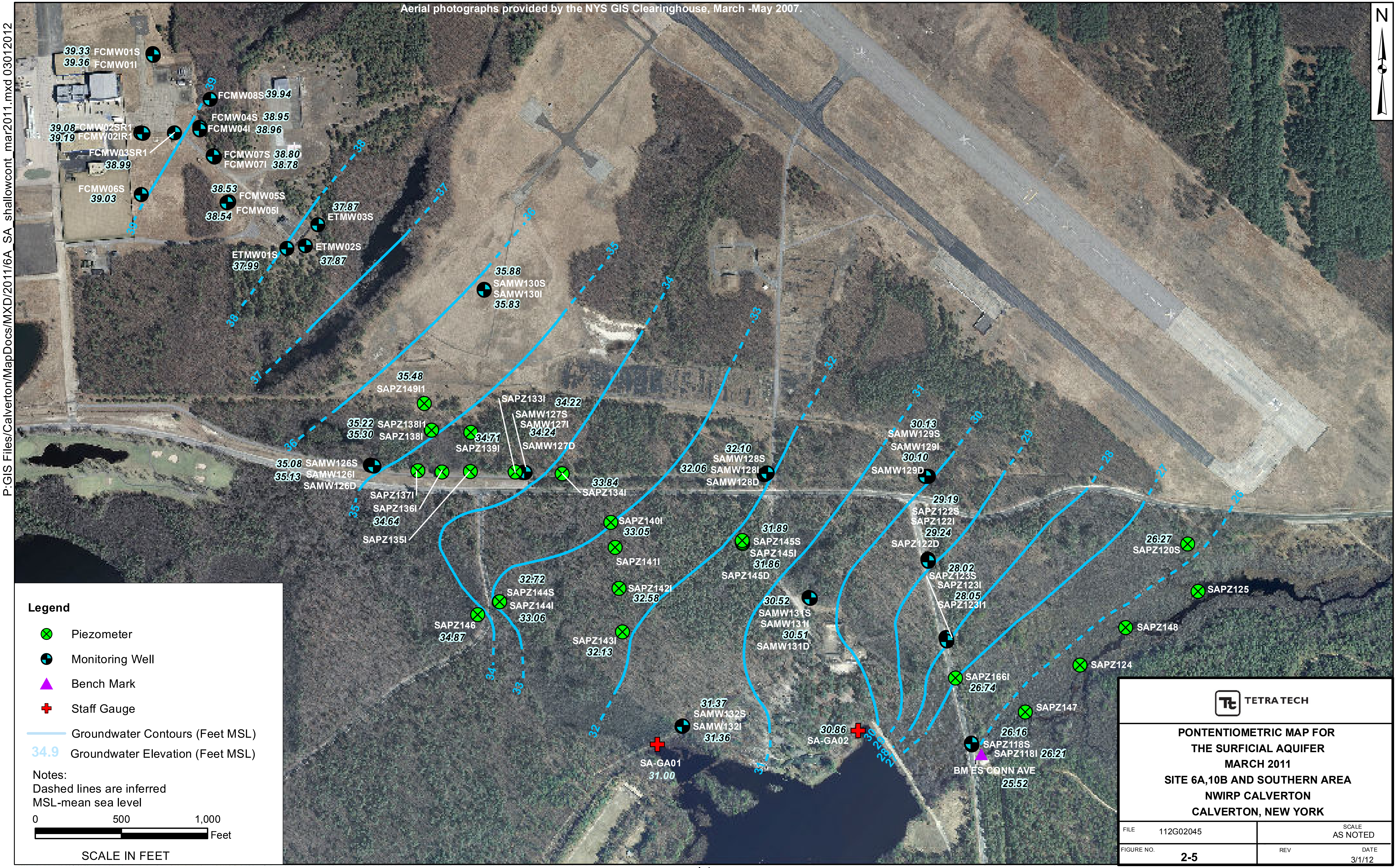
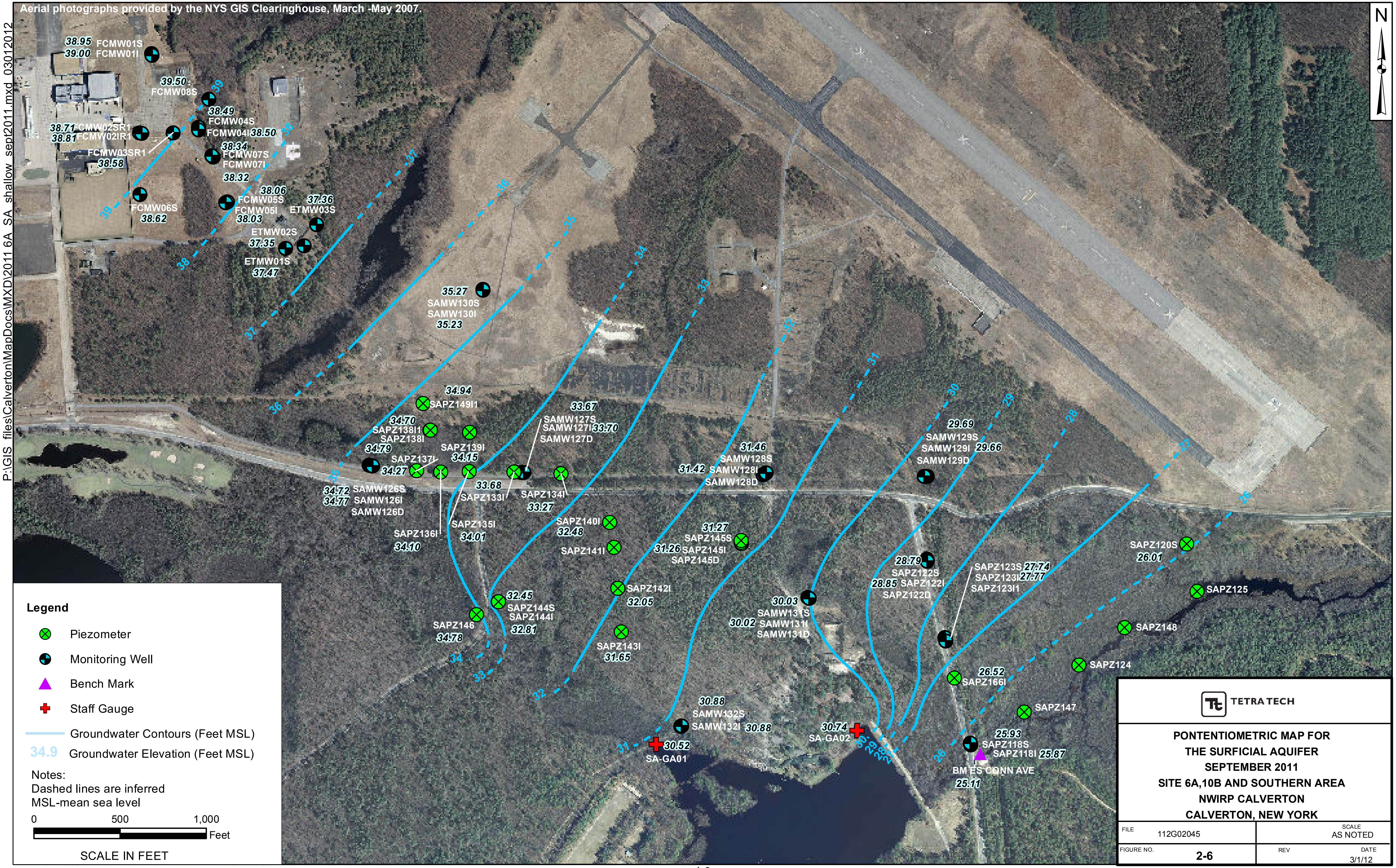


PONTENTIOMETRIC MAP FOR THE SURFICIAL AQUIFER MARCH 2011 SITE 6A,10B AND SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK

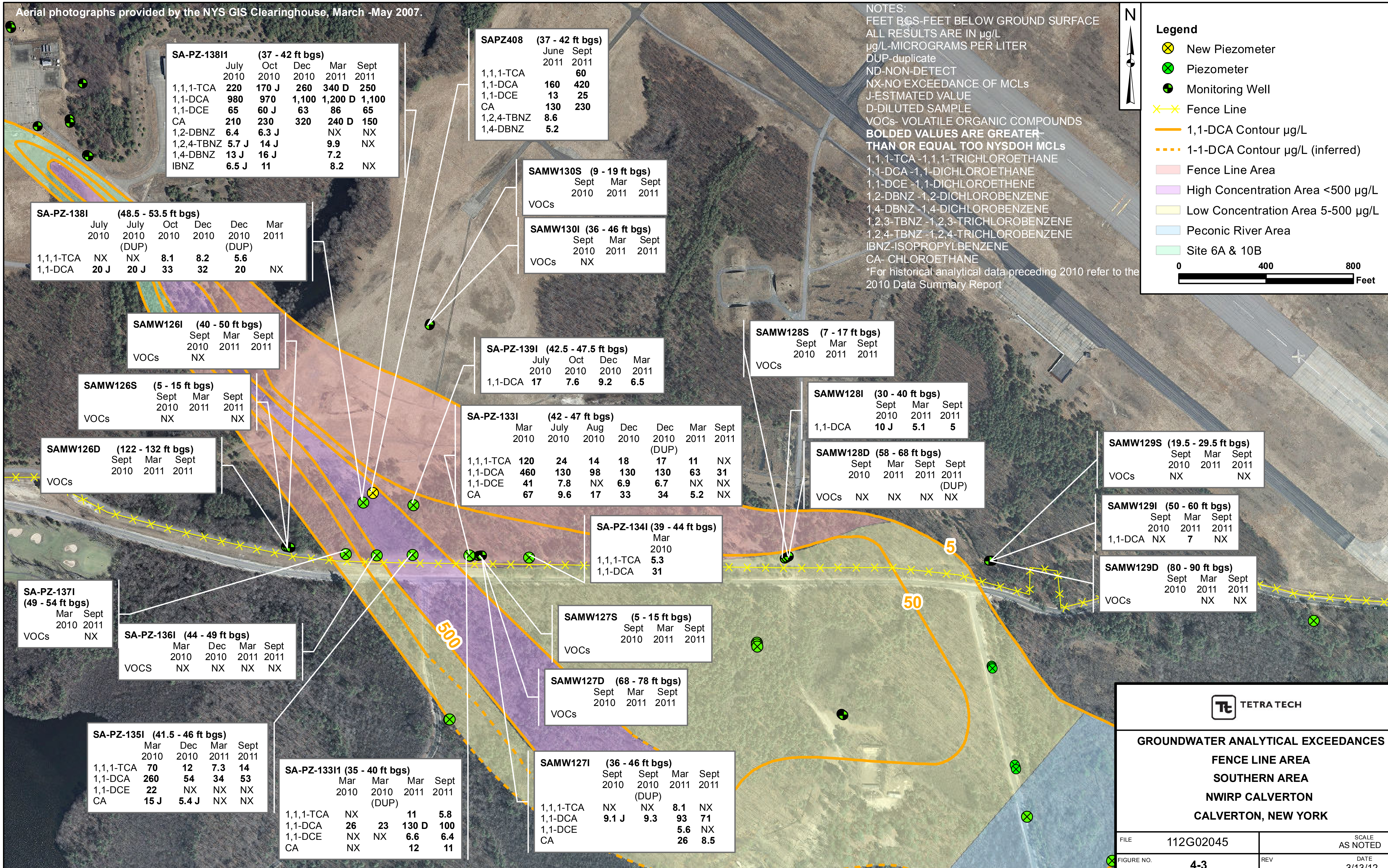
FILE 112G02045	SCALE AS NOTED
FIGURE NO. 2-5	REV DATE 3/1/12

P:\GIS files\Calverton\MapDocs\MXD\2011 6A SA shallow sept2011.mxd 03012012



PONTENTIOMETRIC MAP FOR
THE SURFICIAL AQUIFER
SEPTEMBER 2011
SITE 6A,10B AND SOUTHERN AREA
NWIRP CALVERTON
CALVERTON, NEW YORK

FILE 112G02045	SCALE AS NOTED
FIGURE NO. 2-6	REV	DATE 3/1/12



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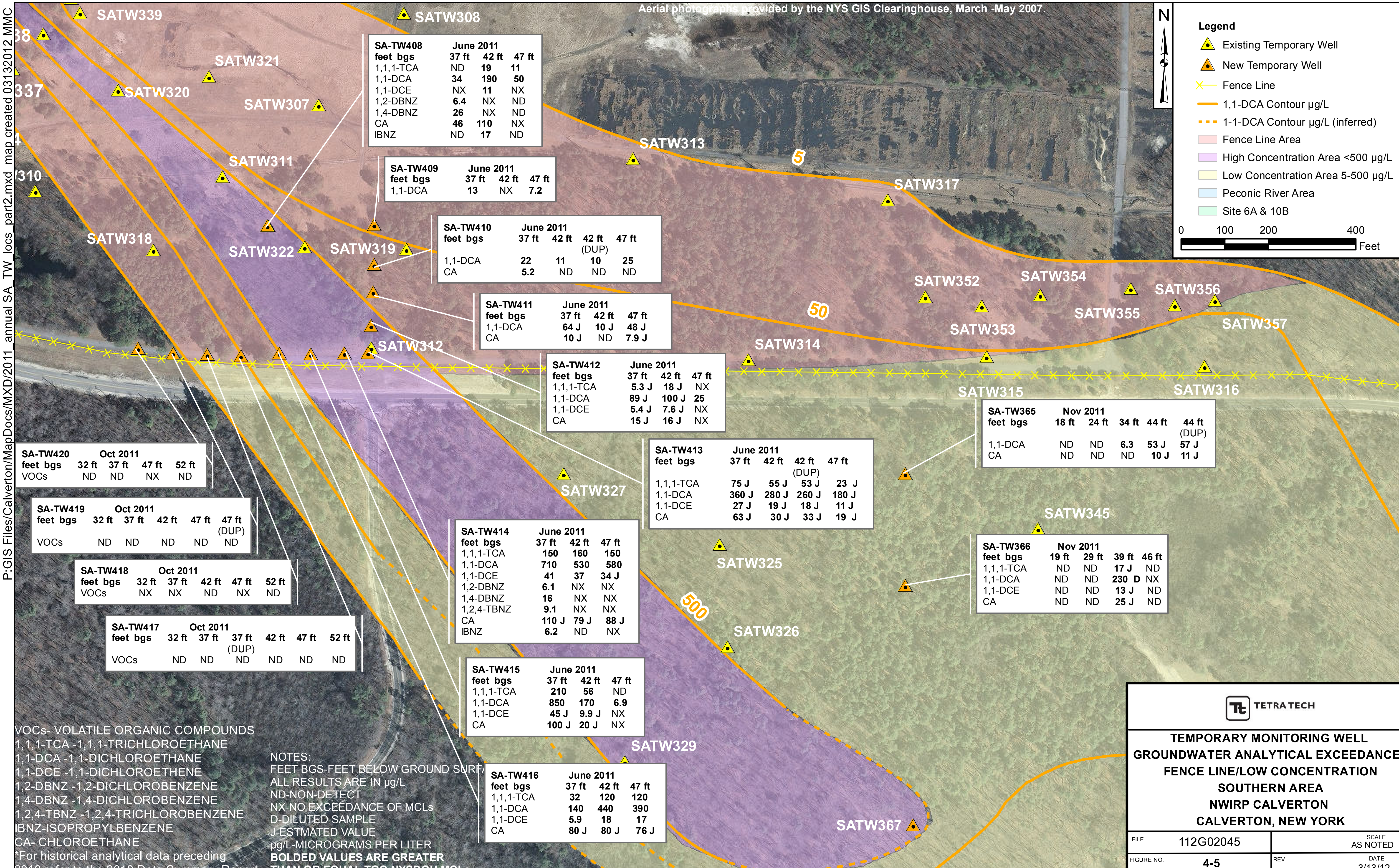

SA-TW408	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1,1-TCA	ND	**19**	**11**
1,1-DCA	**34**	**190**	**50**
1,1-DCE	NX	**11**	NX
1,2-DBNZ	**6.4**	NX	ND
1,4-DBNZ	**26**	NX	ND
CA	**46**	**110**	NX
IBNZ	ND	**17**	ND

SA-TW409	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1-DCA	**13**	NX	**7.2**

SA-TW410	June 2011			
feet bgs	37 ft	42 ft	42 ft (DUP)	47 ft
1,1-DCA	**22**	**11**	**10**	**25**
CA	**5.2**	ND	ND	ND

SA-TW411	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1-DCA	**64 J**	**10 J**	**48 J**
CA	**10 J**	ND	**7.9 J**

SA-TW412	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1,1-TCA	**5.3 J**	**18 J**	NX
1,1-DCA	**89 J**	**100 J**	**25**
1,1-DCE	**5.4 J**	**7.6 J**	NX
CA	**15 J**	**16 J**	NX

SA-TW413	June 2011			
feet bgs	37 ft	42 ft	42 ft (DUP)	47 ft
1,1,1-TCA	**75 J**	**55 J**	**53 J**	**23 J**
1,1-DCA	**360 J**	**280 J**	**260 J**	**180 J**
1,1-DCE	**27 J**	**19 J**	**18 J**	**11 J**
CA	**63 J**	**30 J**	**33 J**	**19 J**

SA-TW414	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1,1-TCA	**150**	**160**	**150**
1,1-DCA	**710**	**530**	**580**
1,1-DCE	**41**	**37**	**34 J**
1,2-DBNZ	**6.1**	NX	NX
1,4-DBNZ	**16**	NX	NX
1,2,4-TBNZ	**9.1**	NX	NX
CA	**110 J**	**79 J**	**88 J**
IBNZ	**6.2**	ND	NX

SA-TW415	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1,1-TCA	**210**	**56**	ND
1,1-DCA	**850**	**170**	**6.9**
1,1-DCE	**45 J**	**9.9 J**	NX
CA	**100 J**	**20 J**	NX

SA-TW416	June 2011		
feet bgs	37 ft	42 ft	47 ft
1,1,1-TCA	**32**	**120**	**120**
1,1-DCA	**140**	**440**	**390**
1,1-DCE	**5.9**	**18**	**17**
CA	**80 J**	**80 J**	**76 J**

SA-TW420	Oct 2011			
feet bgs	32 ft	37 ft	47 ft	52 ft
VOCs	ND	ND	NX	ND

SA-TW419	Oct 2011				
feet bgs	32 ft	37 ft	42 ft	47 ft	47 ft (DUP)
VOCs	ND	ND	ND	ND	ND

SA-TW418	Oct 2011				
feet bgs	32 ft	37 ft	42 ft	47 ft	52 ft
VOCs	NX	NX	ND	NX	ND

SA-TW417	Oct 2011					
feet bgs	32 ft	37 ft	37 ft (DUP)	42 ft	47 ft	52 ft
VOCs	ND	ND	ND	ND	ND	ND

SA-TW365	Nov 2011				
feet bgs	18 ft	24 ft	34 ft	44 ft	44 ft (DUP)
1,1-DCA	ND	ND	**6.3**	**53 J**	**57 J**
CA	ND	ND	ND	**10 J**	**11 J**

SA-TW366	Nov 2011			
feet bgs	19 ft	29 ft	39 ft	46 ft
1,1,1-TCA	ND	ND	**17 J**	ND
1,1-DCA	ND	ND	**230 D**	NX
1,1-DCE	ND	ND	**13 J**	ND
CA	ND	ND	**25 J**	ND

VOCs- VOLATILE ORGANIC COMPOUNDS
1,1,1-TCA -1,1,1-TRICHLOROETHANE
1,1-DCA -1,1-DICHLOROETHANE
1,1-DCE -1,1-DICHLOROETHENE
1,2-DBNZ -1,2-DICHLOROBENZENE
1,4-DBNZ -1,4-DICHLOROBENZENE
1,2,4-TBNZ -1,2,4-TRICHLOROBENZENE
IBNZ-ISOPROPYLBENZENE
CA- CHLOROETHANE
*For historical analytical data preceding 2010 refer to the 2010 Data Summary Report

NOTES:
FEET BGS-FEET BELOW GROUND SURFACE
ALL RESULTS ARE IN µg/L
ND-NON-DETECT
NX-NO EXCEEDANCE OF MCLs
D-DILUTED SAMPLE
J-ESTMATED VALUE
µg/L-MICROGRAMS PER LITER
BOLDED VALUES ARE GREATER THAN OR EQUAL TOO NYSDOH MCLs

TETRA TECH

TEMPORARY MONITORING WELL GROUNDWATER ANALYTICAL EXCEEDANCES FENCE LINE/LOW CONCENTRATION SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK

FILE	SCALE
112G02045	AS NOTED
FIGURE NO. 4-5	REV
	DATE 3/13/12

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes		Cross-gradient Reference Well									Cross-gradient Reference Well			
Location	NYSDOH MCLs (1)	SA-PZ-133I (42-47 ft bgs)									SA-PZ-133I1 (35-40 ft bgs)			
Sample Date		3/31/2010	7/8/2010	10/12/2010	12/15/2010	12/15/2010 (duplicate)	3/8/2011	6/9/2011	6/21/2011	9/19/2011	3/31/2010	6/9/2011	6/21/2011	9/19/2011
VOCs (µg/L)														
1,1,1-Trichloroethane (TCA)	5	120	24	14	18	17	11	9.5	10 J	4.2	2 J	22 J	14	5.8
1,1-Dichloroethane (DCA)	5	460	130	98	130	130	63	76	90 J	31	26	120	170	100
1,1-Dichloroethene (DCE)	5	41	7.8	4.9 J	6.9	6.7	3.9	4.3	4.2 J	2	1.6 J	13 J	8.3	6.4
Chloroethane (CA)	5	67	9.6	17	33	34	5.2	6.7	7.4 J	1.9	4.9 J	22 J	15	11
Benzene	5	1.1 J	ND	ND	0.35 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	2.2 J	ND	ND	ND	ND	ND	ND	ND	ND	1.2 J	ND	ND	ND
1,3-Dichlorobenzene	5	0.65 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	0.91 J	0.70 J	ND	ND	ND	ND	ND	ND	ND	0.36 J	ND	ND	ND
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	3 J	0.98 J	ND	ND	ND	0.84 J	ND	ND	0.89 J	0.75 J	ND	ND	0.62 J
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**688**	**171**	**134**	**188**	**188**	**83**	**96.5**	**111.6**	**39.1**	**34.5**	**177**	**207.3**	**123.2**
DCA/TCA Ratio	--	*3.8*	*5.4*	*7.0*	*7.2*	*7.6*	*5.7*	*8.0*	*9.0*	*7.4*	*13.0*	*5.5*	*12.1*	*17.2*
CA/DCA Ratio	--	*0.15*	*0.07*	*0.17*	*0.25*	*0.26*	*0.08*	*0.09*	*0.08*	*0.06*	*0.19*	*0.18*	*0.09*	*0.11*
CA/TCA Ratio	--	*0.56*	*0.40*	*1.21*	*1.83*	*2.00*	*0.47*	*0.71*	*0.74*	*0.45*	*2.45*	*1.00*	*1.07*	*1.90*
Dissolved Gases (µg/L)														
Methane	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)														
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)														
Iron	300 (2)	--	--	--	--	--	--	--	45.1 J	--	--	--	46.1 J	--
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	--	0	--	--	--	--	--	--	--
Manganese	300 (2)	--	--	--	--	--	--	--	870	--	--	--	2,760	--
Wet Chemistry (mg/L)														
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Water Quality Parameters														
pH	none	5.98	5.87	6.41	5.62	--	5.79	5.68	6.62	6.24	6.27	5.92	6.92	6.41
Specific Conductivity (mS/cm)	none	0.120	0.134	0.103	0.079	--	0.107	0.119	0.082	0.101	0.098	0.107	0.025	0.093
Dissolved Oxygen (mg/L)	none	0	--	0	0	--	-- / 0.6	1.49	0 / 1.0	0.74 / 0.80	--	1.40	0 / 1.0	1.13 / 0.60
Temperature (ºC)	none	11.21	14.72	14.93	10.56	--	7.18	12.16	12.63	12.58	11.21	12.44	13.38	13.73
Oxygen Reduction Potential (mV)	none	104	163	156	-12	--	125	116	81	172	2	70	29	62
Turbidity (NTU)	none	1.53	0	0	0	--	0.35	1.4	35.5	0.91	2.59	0.5	44.9	0.43

Purpose / Notes	NYSDOH MCLs (1)	Cross-gradient Reference Well								
Location		SA-PZ-135 (41.5-46.5 ft bgs)								
Sample Date		3/31/2010	12/14/2010	3/8/2011	6/7/2011	6/21/2011	8/3/2011	8/3/2011	8/4/2011	9/19/2011
VOCs (µg/L)										
1,1,1-Trichloroethane (TCA)	5	70	12	7.3	5.6	4.6	0.52 J	6.3	4.0	14
1,1-Dichloroethane (DCA)	5	260	54	34	35	27	19	31	29	53
1,1-Dichloroethene (DCE)	5	22	3.3 J	2.6	2.8	1.9	1.1	2.0	1.8	3.5
Chloroethane (CA)	5	15 J	5.4	1.2	1.8	2.1	ND	ND	1.3	2.8
Benzene	5	0.35 J	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	0.38 J	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	0.91 J	ND	ND	ND	ND	ND	ND	ND	ND
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**367**	**74.7**	**45.1**	**45.2**	**35.6**	**20.62**	**39.3**	**36.1**	**73.3**
DCA/TCA Ratio	--	*3.7*	*4.5*	*4.7*	*6.3*	*5.9*	*37*	*4.9*	*7.3*	*3.8*
CA/DCA Ratio	--	*0.06*	*0.10*	*0.04*	*0.05*	*0.08*	--	--	*0.04*	*0.05*
CA/TCA Ratio	--	*0.21*	*0.45*	*0.16*	*0.32*	*0.46*	--	--	*0.33*	*0.20*
Dissolved Gases (µg/L)										
Methane	none	--	--	--	--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)										
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--
Metals (µg/L)										
Iron	300 (2)	--	--	--	--	26.7 J	--	--	--	--
Fe^{2+} (Ferrous Iron)	none	--	--	0	--	--	--	--	--	--
Manganese	300 (2)	--	--	--	--	927	--	--	--	--
Wet Chemistry (mg/L)										
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--	--	--	--
Water Quality Parameters										
pH	none	5.75	4.75	5.77	4.99	7.02	5.28	6.18	4.99	5.82
Specific Conductivity (mS/cm)	none	0.123	0.090	0.109	0.122	0.088	0.108	0.105	0.098	0.101
Dissolved Oxygen (mg/L)	none	0	--	-- / 1.0	1.56	0 / 1.8	0	0	0.13	0.58 / 0.20
Temperature (°C)	none	10.83	10.8	11.14	13.01	14.12	13.41	14.55	13.56	13.83
Oxygen Reduction Potential (mV)	none	109	169	116	160	75	226	219	338	116
Turbidity (NTU)	none	3.52	0	0.77	0.5	85.6	0	0.55	0.32	0.01

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes	NYSDOH MCLs (1)	Cross-gradient Reference Well									Cross-gradient Reference Well		
Location		SA-PZ-136 (44-49 ft bgs)									SA-PZ-137 (49-54 ft bgs)		
Sample Date		3/31/2010	12/14/2010	3/8/2011	6/7/2011	6/21/2011	8/3/2011	8/3/2011	8/4/2011	9/19/2011	3/31/2010	6/8/2011	9/19/2011
VOCs (µg/L)													
1,1,1-Trichloroethane (TCA)	5	ND	ND	ND	ND	ND	14	12	23	ND	ND	ND	ND
1,1-Dichloroethane (DCA)	5	1.5 J	1.5 J	1.8	ND	1.5	110	100	130	1.7	ND	1.2	1.2
1,1-Dichloroethene (DCE)	5	ND	ND	ND	ND	ND	6.4	5.3	8.6	ND	ND	ND	ND
Chloroethane (CA)	5	ND	ND	ND	ND	ND	9.3	8.6	12	ND	ND	ND	ND
Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**1.5**	**1.5**	**1.8**	--	**1.5**	**139.7**	**125.9**	**173.6**	**1.7**	**0**	**1.2**	**1.2**
DCA/TCA Ratio	**--**	--	--	--	--	--	*7.9*	*8.3*	*5.7*	--	--	--	--
CA/DCA Ratio	**--**	--	--	--	--	--	*0.08*	*0.09*	*0.09*	--	--	--	--
CA/TCA Ratio	**--**	--	--	--	--	--	*0.66*	*0.72*	*0.52*	--	--	--	--
Dissolved Gases (µg/L)													
Methane	none	--	--	--	--	--	--	--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)													
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)													
Iron	300 (2)	--	--	--	--	877	--	--	--	--	--	--	--
Fe^{2+} (Ferrous Iron)	none	--	--	1,200	--	--	--	--	--	--	--	--	--
Manganese	300 (2)	--	--	--	--	1,600	--	--	--	--	--	--	--
Wet Chemistry (mg/L)													
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--	--	--	--	--	--	--
Water Quality Parameters													
pH	none	6.10	5.64	5.95	5.60	7.12	6.52	6.61	6.05	6.15	6.27	5.78	6.51
Specific Conductivity (mS/cm)	none	0.129	0.123	0.118	0.130	0.096	0.317	0.304	0.246	0.112	0.133	0.134	0.106
Dissolved Oxygen (mg/L)	none	--	0	-- / 0.8	1.4	0 / 1.0	0	0	0.14	0.75 / 0.60	0	1.64	0.36 / 0.20
Temperature (°C)	none	10.23	10.45	10.81	11.56	13.49	13.93	15.32	13.92	13.51	10.28	11.39	13.91
Oxygen Reduction Potential (mV)	none	-7	-56	98	65	4	-55	-92	-5	94	4	47	88
Turbidity (NTU)	none	23.3	4.70	1.96	38.5	3.38	4.19	8.47	4.67	1.06	7.75	2.1	0.46

Purpose / Notes	NYSDOH MCLs (1)	Upgradient Monitoring Well						
Location		SA-PZ-138I (48.5-53.5 ft bgs)						
Sample Date		7/8/2010	7/8/2010 (duplicate)	10/12/2010	10/12/2010 (duplicate)	12/15/2010	3/8/2011	6/21/2011
VOCs (µg/L)								
1,1,1-Trichloroethane (TCA)	5	4.4 J	4.4 J	8.1	8.2	5.6	ND	1.5
1,1-Dichloroethane (DCA)	5	20 J	20 J	33	32	20	4.1	9.6
1,1-Dichloroethene (DCE)	5	1.2 J	1.0 J	1.7 J	2.0 J	1.2 J	ND	0.6 J
Chloroethane (CA)	5	ND	1.7 J	ND	ND	ND	ND	ND
Benzene	5	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**26**	**27**	**43**	**42**	**27**	**4.1**	**12**
DCA/TCA Ratio	--	*4.5*	*4.5*	*4.1*	*3.9*	*3.6*	--	*6.4*
CA/DCA Ratio	--	--	*0.09*	--	--	--	--	--
CA/TCA Ratio	--	--	*0.39*	--	--	--	--	--
Dissolved Gases (µg/L)								
Methane	none	--	--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)								
Dehalococcoides sp.	none	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--
Metals (µg/L)								
Iron	300 (2)	--	--	--	--	--	--	ND
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	--	0	0
Manganese	300 (2)	--	--	--	--	--	--	731
Wet Chemistry (mg/L)								
Nitrate (as N)	10	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--	--
Water Quality Parameters								
pH	none	5.88	--	5.85	--	6.38	5.62	5.67
Specific Conductivity (mS/cm)	none	0.134	--	0.099	--	0.089	0.114	0.094
Dissolved Oxygen (mg/L)	none	--	--	0.24	--	--	-- / 1.5	0 / 0.3
Temperature (°C)	none	13.67	--	13.0	--	11.2	6.57	15.32
Oxygen Reduction Potential (mV)	none	-6.0	--	42	--	90	144	161
Turbidity (NTU)	none	0	--	0	--	0	0.3	0

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes	NYSDOH MCLs [1]	Upgradient Monitoring Well							Cross-gradient Reference Well					
Location		SA-PZ-138I1 (37-42 ft bgs)							SA-PZ-139I (42.5-47.5 ft bgs)					
Sample Date		7/6/2010	10/12/2010	12/15/2010	3/8/2011	6/21/2011 [3]	6/21/2011 [3] (duplicate)	9/20/2011	7/8/2010	10/12/2010	12/15/2010	3/8/2011	6/10/2011	6/20/2011
VOCs (µg/L)														
1,1,1-Trichloroethane (TCA)	5	220	170 J	260	340	320	300	250	2.3 J	0.92 J	1.3 J	ND	ND	ND
1,1-Dichloroethane (DCA)	5	980	970	1,100	1,200	1,500	1,500	1,100	17	7.6	9.2	6.5	5.9 J	4.6
1,1-Dichloroethene (DCE)	5	65	60 J	63	86	100	85	65	0.94 J	ND	ND	ND	ND	ND
Chloroethane (CA)	5	210	230	320	240	250	280	150	1.8 J	ND	ND	ND	ND	ND
Benzene	5	3.4 J	4.4 J	ND	2.6	ND	ND	1.6	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	13 J	16 J	ND	7.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	5	3.1 J	4.0 J	ND	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	6.4 J	6.3 J	ND	3.7	ND	ND	1.9	ND	ND	ND	ND	ND	ND
Isopropyl Benzene	5	6.5 J	11	ND	8.2	ND	ND	2.5	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	5.7 J	14 J	ND	9.9	ND	ND	4.8	ND	ND	ND	ND	ND	ND
Chlorobenzene	5	ND	1.1 J	ND	0.55 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**1475**	**1430**	**1743**	**1866**	**2170**	**2165**	**1565**	**22**	**9**	**10.5**	**6.5**	**5.9**	**4.6**
DCA/TCA Ratio	--	*4.5*	*4.2*	*4.2*	*3.5*	*4.7*	*5.0*	*4.4*	*7.4*	*8.3*	*7.1*	--	--	--
CA/DCA Ratio	--	*0.21*	*0.24*	*0.29*	*0.20*	*0.17*	*0.19*	*0.14*	*0.11*	--	--	--	--	--
CA/TCA Ratio	--	*0.95*	*1.35*	*1.23*	*0.71*	*0.78*	*0.93*	*0.60*	*0.78*	--	--	--	--	--
Dissolved Gases (µg/L)														
Methane	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)														
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)														
Iron	300 [2]	--	--	--	--	ND	ND	--	--	--	--	--	--	40.7 J
Fe^{2+} (Ferrous Iron)	none	--	--	--	0	--	--	--	--	--	--	0	--	--
Manganese	300 [2]	--	--	--	--	5,220	5,260	--	--	--	--	--	--	172
Wet Chemistry (mg/L)														
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--	--	--	--	--	--	--	--
Water Quality Parameters														
pH	none	6.12	5.93	5.97	5.74	6.98	--	6.15	5.28	6.15	5.53	5.71	5.58	6.47
Specific Conductivity (mS/cm)	none	0.190	0.146	0.139	0.181	0.135	--	0.153	0.099	0.101	0.087	0.108	0.126	0.083
Dissolved Oxygen (mg/L)	none	1.67	0.23	--	-- / 1.0	0 / 0.8	--	-- / 1.0	0	0	0	-- / 0.6	1.52	0 / 0.8
Temperature (°C)	none	14.27	13.1	11.0	6.31	15.49	--	13.96	13.67	15.84	11.07	6.68	12.26	12.67
Oxygen Reduction Potential (mV)	none	62	127	120	130	82	--	50	137	183	-1	127	144	66
Turbidity (NTU)	none	0.45	0	0.24	0.31	0	--	0	1.29	0.08	0	0.29	0.5	20

Purpose / Notes	NYSDOH MCLs (1)	Upgradient Monitoring Well					Injection/Extraction Well						
Location		SA-PZ-149I1 (32-37 ft bgs)					SA-PZ-151I1 (34-39 ft bgs)						
Sample Date		7/8/2010	10/12/2010	12/15/2010	3/8/2011	6/20/2011	7/7/2010	10/12/2010	10/12/2010 (duplicate)	12/15/2010	3/8/2011	3/8/2011 (duplicate)	6/22/2011 (3)
VOCs (µg/L)													
1,1,1-Trichloroethane (TCA)	5	6.6	ND	ND	ND	ND	110	36	35	32	36 J	39 J	ND
1,1-Dichloroethane (DCA)	5	40	3.6 J	6.7	18	12 J	490	180	170	190	310	310	390
1,1-Dichloroethene (DCE)	5	2.6 J	ND	0.82 J	1.7	1.3 J	33	14	13	13	20 J	22 J	24
Chloroethane (CA)	5	9.8	ND	10	18	14 J	99	91	91	140	220	220	260
Benzene	5	ND	ND	ND	ND	ND	1.1 J	1.3 J	1.2 J	1.6 J	2.1 J	2.3 J	ND
1,4-Dichlorobenzene	5	5.4	4.7 J	13	28	12 J	ND	11	11	22	23 J	26 J	ND
1,3-Dichlorobenzene	5	1.1 J	1.0 J	2.7 J	6.0	2.5 J	ND	2.5 J	2.3 J	4.0 J	5.3 J	5.8 J	ND
1,2-Dichlorobenzene	5	1.6 J	1.2 J	3.0 J	7.8	3.2 J	ND	3.6 J	3.6 J	5.8 J	6.9 J	7.5 J	ND
Isopropyl Benzene	5	0.42 J	ND	0.39 J	1.8	ND	ND	0.49 J	0.47 J	1.1 J	2.5 J	2.7 J	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	1.9	ND	ND	1.8 J	1.8 J	ND	9.6 J	11 J	ND
Chlorobenzene	5	1.3 J	ND	ND	5.1	1.5 J	ND	ND	ND	ND	2.7 J	3.0 J	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**59**	**4**	**18**	**38**	**27**	**732**	**321**	**309**	**375**	**586**	**591**	**674**
DCA/TCA Ratio	**--**	*6.1*	*--*	*--*	*--*	*--*	*4.5*	*5.0*	*4.9*	*5.9*	*8.6*	*7.9*	*--*
CA/DCA Ratio	**--**	*0.25*	*--*	*1.5*	*1.0*	*0.9*	*0.20*	*0.15*	*1.9*	*1.4*	*0.71*	*0.71*	*0.67*
CA/TCA Ratio	**--**	*1.48*	*--*	*--*	*--*	*--*	*0.90*	*2.53*	*2.60*	*4.38*	*6.11*	*5.64*	*--*
Dissolved Gases (µg/L)													
Methane	none	--	--	--	--	--	110	140 D	300 D	210 D	402 D	320 D	344
Ethane	none	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Ethene	none	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND
Dechlorinating Bacteria (cells/mL)													
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)													
Iron	300 (2)	--	--	--	--	112	1,500	1,010	1,020	1,170	214 J	225 J	612
Fe^{2+} (Ferrous Iron)	none	--	--	--	200	--	--	--	--	--	400	400	--
Manganese	300 (2)	--	--	--	--	1,630	4,680	5,460	5,550	5,580	5,460	5,750	5,270
Wet Chemistry (mg/L)													
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--	--	--	ND
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--	--	--	ND
Chloride	250	--	--	--	--	--	--	--	--	--	--	--	5.02
Sulfide	none	--	--	--	--	--	--	--	--	--	--	--	ND
TOC	none	--	--	--	--	--	1.5	1.1	1.33	1.31 J	2.6 J	3.2 J	2.1
Water Quality Parameters													
pH	none	5.83	5.96	6.70	5.78	6.69	6.38	6.10	--	5.90	5.66	--	6.42
Specific Conductivity (mS/cm)	none	0.103	0.09	0.079	0.102	0.063	0.174	0.127	--	0.123	0.161	--	0.123
Dissolved Oxygen (mg/L)	none	0	0.3	--	-- / 1.0	0 / 0.8	--	0.39	--	0	-- / 1.0	--	0 / 1.2
Temperature (°C)	none	13.78	13.5	11.3	6.98	12.66	14.65	13.2	--	10.78	7.03	--	12.54
Oxygen Reduction Potential (mV)	none	42	71	69	98	18	-124	-16	--	-95	109	--	-51
Turbidity (NTU)	none	0	0	0.74	0.28	31.4	0.84	0	--	0.03	0.82	--	0

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes		Injection/Extraction Well						Downgradient Monitoring Well					
Location	NYSDOH MCLs (1)	SA-PZ-155I (41-46 ft bgs)						SA-PZ-157I (41-46 ft bgs)					
Sample Date		7/7/2010	7/7/2010 (duplicate)	10/12/2010	12/15/2010	3/7/2011	6/22/2011	7/8/2010	10/11/2010	12/14/2010	3/7/2011	5/9/2011	6/21/2011
VOCs (µg/L)													
1,1,1-Trichloroethane (TCA)	5	38	36	15	16	19	7.8	46	15	17	21	31 J	9.7
1,1-Dichloroethane (DCA)	5	150	150	65	70	70	43	180	65	75	71	280 J	45
1,1-Dichloroethene (DCE)	5	12	11	3.7 J	3.4 J	5.4	2.4	13	4.2 J	4.1 J	5.2	17 J	3.4
Chloroethane (CA)	5	17	19	ND	ND	7.5	2.2	24	5.7	7.6	3.3	200 J	3.4 J
Benzene	5	0.33 J	0.31 J	ND	ND	ND	ND	0.43 J	ND	ND	ND	1.7 J	ND
1,4-Dichlorobenzene	5	0.31 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.6 J	ND
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4 J	ND
1,2-Dichlorobenzene	5	ND	0.4 J	ND	ND	ND	ND	ND	ND	ND	ND	1.9 J	ND
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5 J	0.85 J
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.53 J	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**217**	**216**	**84**	**89.4**	**101.9**	**55.4**	**263**	**90**	**104**	**101**	**528**	**61.5**
DCA/TCA Ratio	--	*3.9*	*4.2*	*4.3*	*4.4*	*3.7*	*5.5*	*3.9*	*4.3*	*4.4*	*3.4*	*9.0*	*4.6*
CA/DCA Ratio	--	*0.11*	*0.13*	--	--	*0.11*	*0.05*	*0.13*	*0.09*	*0.10*	*0.05*	*0.71*	*0.08*
CA/TCA Ratio	--	*0.45*	*0.53*	--	--	*0.39*	*0.28*	*0.52*	*0.38*	*0.45*	*0.16*	*6.45*	*0.35*
Dissolved Gases (µg/L)													
Methane	none	9	12	3.7	2.5	8.1	ND	14	2.7	12	ND	--	ND
Ethane	none	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND
Ethene	none	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND
Dechlorinating Bacteria (cells/mL)													
Dehalococcoides sp.	none	--	--	--	--	--	--	0.20 J	--	1.6	--	--	ND
Dehalobacter sp.	none	--	--	--	--	--	--	50.2	--	40.4	--	--	544
Metals (µg/L)													
Iron	300 (2)	4,320	4,230	128 J	2,080	499 J	205	275	460 J	10,600	3,090 J	--	978
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	600	--	--	--	--	2,200	--	--
Manganese	300 (2)	302	292	571	484	340	291	293	889	1,400	533	--	1,050
Wet Chemistry (mg/L)													
Nitrate (as N)	10	--	--	--	--	--	2.11	0.702	--	0.074 J	--	--	1.02
Nitrite (as N)	1	--	--	--	--	--	0.226	ND	--	ND	--	--	0.236
Chloride	250	--	--	--	--	--	7.42	8.31	--	4.12	--	--	7.48
Sulfide	none	--	--	--	--	--	ND	ND	--	ND	--	--	ND
TOC	none	0.83 J	0.77 J	ND	ND	0.989 J	0.662	0.73 J	ND	122 J	1.1 J	2.4	0.599
Water Quality Parameters													
pH	none	5.86	--	6.18	5.73	5.69	5.69	5.57	6.20	6.05	5.69	5.97	5.31
Specific Conductivity (mS/cm)	none	0.118	--	0.110	0.090	0.128	0.100	0.107	0.121	0.142	0.133	0.156	0.096
Dissolved Oxygen (mg/L)	none	0	--	0.68	0	-- / 1.0	0.55 / 1.0	0	0.89	0	-- / 0.8	0.37 /0.70, 0.80	1.99 / 1.0
Temperature (ºC)	none	13.47	--	15.62	11.07	6.94	15.5	13.51	15.41	10.94	7.75	12.21	16.39
Oxygen Reduction Potential (mV)	none	-32	--	133	-51	88	54	73	79	-155	73	24	106
Turbidity (NTU)	none	5.42	--	0	1.69	0.56	0	1.78	0	0	0.57	0.75	0

Purpose / Notes	NYSDOH MCLs (1)	Downgradient Monitoring Well							
Location		SA-PZ-157I1 (33-38 ft bgs)							
Sample Date		7/7/2010	10/11/2010	12/14/2010	12/14/2010 (duplicate)	3/7/2011	5/9/2011	6/21/2011	9/21/2011
VOCs (µg/L)									
1,1,1-Trichloroethane (TCA)	5	73	48 J	20	21	20 J	16 J	23	46
1,1-Dichloroethane (DCA)	5	340	220	100	100	190	140	280	540
1,1-Dichloroethene (DCE)	5	23	17 J	7.6	7.9	14 J	13 J	19	25
Chloroethane (CA)	5	57	57 J	49	49	160 J	130	200	430
Benzene	5	0.81 J	0.84 J	ND	ND	1.7 J	1.9 J	ND	2.1
1,4-Dichlorobenzene	5	ND	6.1 J	7.3	7.4	26 J	37 J	26	19
1,3-Dichlorobenzene	5	ND	1.3 J	1.4 J	1.4 J	5.6 J	7.3 J	5.9 J	4.5
1,2-Dichlorobenzene	5	ND	2.3 J	2.1 J	2.2 J	7.4 J	9.8 J	7.4 J	5.9
Isopropyl Benzene	5	ND	ND	ND	ND	1.7 J	3.0 J	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	9.4 J	8.6 J	6.3 J	9.6
Chlorobenzene	5	ND	ND	0.73 J	ND	3.0 J	5.1 J	ND	1.7
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**493**	**342**	**177**	**177.9**	**384**	**299**	**522**	**1041**
DCA/TCA Ratio	--	*4.7*	*4.6*	*5.0*	*4.8*	*9.5*	*8.8*	*12.2*	*11.7*
CA/DCA Ratio	--	*0.17*	*0.26*	*0.49*	*0.49*	*1.2*	*0.93*	*0.71*	*0.80*
CA/TCA Ratio	--	*0.78*	*1.19*	*2.45*	*2.33*	*8.00*	*8.13*	*8.70*	*9.35*
Dissolved Gases (µg/L)									
Methane	none	80	66	78 D	90 D	258 D	--	207	--
Ethane	none	ND	ND	ND	ND	ND	--	ND	--
Ethene	none	ND	ND	ND	ND	ND	--	ND	--
Dechlorinating Bacteria (cells/mL)									
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--
Metals (µg/L)									
Iron	300 (2)	93.4 J	82.4 J	2,610	2,580	1,150 J	--	776	--
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	1,400	--	--	--
Manganese	300 (2)	4,430	5,210	5,540	5,510	5,580	--	5,200	--
Wet Chemistry (mg/L)									
Nitrate (as N)	10	--	--	ND	--	--	--	ND	--
Nitrite (as N)	1	--	--	ND	--	--	--	ND	--
Chloride	250	--	--	6.65	--	--	--	4.51	--
Sulfide	none	--	--	ND	--	--	--	ND	--
TOC	none	1.3	0.94 J	107 J	ND	2.5 J	2.1	1.9	--
Water Quality Parameters									
pH	none	5.92	6.53	5.86	--	5.79	6.11	5.37	5.86
Specific Conductivity (mS/cm)	none	0.132	0.137	0.134	--	0.182	0.154	0.129	0.145
Dissolved Oxygen (mg/L)	none	0	0.57	0	--	-- / 0.8	0 / 0.6	1.41 / 0.8	0.63 / 0.05
Temperature (°C)	none	13.80	15.34	10.79	--	7.43	12.08	15.42	13.66
Oxygen Reduction Potential (mV)	none	71	121	-116	--	58	42	0	51
Turbidity (NTU)	none	0.09	0	0	--	0.47	0.71	0.07	0.16

Purpose / Notes	NYSDOH MCLs (1)	Downgradient Monitoring Well						Downgradient Monitoring Well					
Location		SA-PZ-158I (41-46 ft bgs)						SA-PZ-158I1 (33-38 ft bgs)					
Sample Date		7/6/2010	10/11/2010	12/13/2010	3/7/2011	5/9/2011	6/20/2011	7/6/2010	10/11/2010	12/13/2010	3/7/2011	5/9/2011	6/20/2011
VOCs (µg/L)													
1,1,1-Trichloroethane (TCA)	5	51	7.9	9.4	11 J	14	13 J	66	39	49	21 J	6.5	ND
1,1-Dichloroethane (DCA)	5	230	43	42	43 J	71	63 J	340	160	200	170	110	190
1,1-Dichloroethene (DCE)	5	15	2.6 J	2.1 J	3.0 J	5.0	4.6 J	19	12	15	12 J	8.5	15
Chloroethane (CA)	5	26	ND	ND	1.6 J	14	11 J	52	27	62	130	130	170
Benzene	5	0.52 J	ND	ND	ND	ND	ND	0.77 J	0.51 J	0.77 J	1.4 J	1.5	ND
1,4-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	2.8 J	6.4	17 J	30	ND
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	0.69 J	1.3 J	3.5 J	6.0	ND
1,2-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	1.2 J	2.1 J	5.0 J	7.6	5.3 J
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.7 J	2.2	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	1.4 J	2.0 J	6.9 J	6.6	6.8 J
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	0.70 J	1.8 J	4.0	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**322**	**54**	**54**	**58.6**	**104**	**91.6**	**477**	**238**	**326**	**333**	**255**	**375**
DCA/TCA Ratio	--	*4.5*	*5.4*	*4.5*	*3.9*	*5.1*	*4.8*	*5.2*	*4.1*	*4.1*	*8.1*	*16.9*	--
CA/DCA Ratio	--	*0.11*	--	--	*0.04*	*0.20*	*0.17*	*0.15*	*0.17*	*0.31*	*0.76*	*1.18*	*0.89*
CA/TCA Ratio	--	*0.51*	--	--	*0.15*	*1.00*	*0.85*	*0.79*	*0.69*	*1.27*	*6.19*	*20*	--
Dissolved Gases (µg/L)													
Methane	none	--	--	--	--	--		--	--	--	--	--	--
Ethane	none	--	--	--	--	--	--	--	--	--	--	--	--
Ethene	none	--	--	--	--	--	--	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)													
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)													
Iron	300 (2)	--	--	--	--	--	6,110	--	--	--	--	--	1,370
Fe^{2+} (Ferrous Iron)	none	--	--	--	2,600	--	--	--	--	--	2,400	--	--
Manganese	300 (2)	--	--	--	--	--	708	--	--	--	--	--	5,450
Wet Chemistry (mg/L)													
Nitrate (as N)	10	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--	--	--	--	--	--	--
TOC	none	--	--	--	--	ND	--	--	--	--	--	2.7	--
Water Quality Parameters													
pH	none	6.27	6.17	7.62	6.29	6.19	6.53	6.45	6.14	6.08	6.01	6.11	6.35
Specific Conductivity (mS/cm)	none	0.151	0.143	0.107	0.161	0.137	0.093	0.161	0.106	0.135	0.139	0.158	0.123
Dissolved Oxygen (mg/L)	none	1.57	0.27	--	-- / 6.0	0 / 0.3	0 / 0.8	1.59	0.24	0	-- / 2.0	0 / 0.6	0 / 1.0
Temperature (°C)	none	14.87	14.4	11.9	11.11	12.06	12.59	14.12	13.7	11.87	10.95	12.23	12.95
Oxygen Reduction Potential (mV)	none	-224	-76	-55	32	-29	-76	-224	-94	-119	69	16	-30
Turbidity (NTU)	none	0.56	0.30	0	0.63	2.44	83.3	1.20	0.13	0	0.83	4.15	220

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes	NYSDOH MCLs (1)	Downgradient Monitoring Well							
Location		SA-PZ-159I (41-46 ft bgs)							
Sample Date		7/8/2010	10/12/2010	12/14/2010	3/7/2011	4/19/2011	4/20/2011	5/9/2011	6/21/2011
VOCs (µg/L)									
1,1,1-Trichloroethane (TCA)	5	75	5.6	25	18	21 J	24 J	16	15
1,1-Dichloroethane (DCA)	5	300	35	100	65	89 J	100 J	90	130
1,1-Dichloroethene (DCE)	5	22	2.2 J	6.7	4.9	5.6 J	6.8 J	6.2	7.3
Chloroethane (CA)	5	35	3.3 J	9.7	3.3	10 J	14 J	28	99
Benzene	5	0.57 J	ND	ND	ND	ND	ND	ND	0.81 J
1,4-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	2.3
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	0.72 J
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	1.2
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**432**	**46**	**141**	**91.2**	**126**	**145**	**140**	**251**
DCA/TCA Ratio	--	*4.0*	*6.3*	*4.0*	*3.6*	*4.2*	*4.2*	*5.6*	*8.7*
CA/DCA Ratio	--	*0.12*	*0.09*	*0.10*	*0.05*	*0.11*	*0.14*	*0.31*	*0.76*
CA/TCA Ratio	--	*0.47*	*0.59*	*0.39*	*0.18*	*0.48*	*0.58*	*1.75*	*6.60*
Dissolved Gases (µg/L)									
Methane	none	13	29	2.4	ND	--	--	--	39
Ethane	none	ND	ND	ND	ND	--	--	--	ND
Ethene	none	ND	ND	ND	ND	--	--	--	ND
Dechlorinating Bacteria (cells/mL)									
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--
Metals (µg/L)									
Iron	300 (2)	ND	7,990	9,680	7,440 J	--	--	--	7,910
Fe^{2+} (Ferrous Iron)	none	--	--	--	2,200	--	--	--	--
Manganese	300 (2)	388	799	1,090	707	--	--	--	845
Wet Chemistry (mg/L)									
Nitrate (as N)	10	--	--	--	--	--	--	--	ND
Nitrite (as N)	1	--	--	--	--	--	--	--	ND
Chloride	250	--	--	--	--	--	--	--	6.28
Sulfide	none	--	--	--	--	--	--	--	ND
TOC	none	0.69 J	116.16	4.70 J	1.5 J	ND	--	1.2	1.1
Water Quality Parameters									
pH	none	5.79	6.58	7.96	6.12	5.73	6.34	6.30	7.54
Specific Conductivity (mS/cm)	none	0.129	0.159	0.117	0.129	0.148	0.144	0.140	0.109
Dissolved Oxygen (mg/L)	none	--	0	--	-- / 1.0	-- / 0.4	0 / 0.4	0 / 0.8	0 / 1.0
Temperature (°C)	none	14.03	15.57	11.1	11.02	10.99	10.87	14.19	13.41
Oxygen Reduction Potential (mV)	none	105	-32	-53	46	23	-1	-24	-60
Turbidity (NTU)	none	0.55	0	0.69	0.85	0	0.33	4.04	0.72

TABLE A-1
GROUNDWATER DATA
SOUTHERN AREA - OPTION ANALYSIS REPORT
NWIRP CALVERTON, NEW YORK

Purpose / Notes		Downgradient Monitoring Well							
Location	**NYSDOH MCLs (1)**	**SA-PZ-159I1 (33-38 ft bgs)**							
Sample Date		**7/8/2010**	**10/12/2010**	**12/14/2010**	**12/16/2010**	**3/8/2011**	**5/9/2011**	**6/21/2011**	**6/21/2011 (duplicate)**
VOCs (µg/L)									
1,1,1-Trichloroethane (TCA)	5	41	44 J	38	--	13	9	3.2	2.8
1,1-Dichloroethane (DCA)	5	250	200	180	--	89 J	150	59	62
1,1-Dichloroethene (DCE)	5	18	14 J	12	--	8.8	13	3.6	3.7
Chloroethane (CA)	5	50	39 J	50	--	87	130	66	70
Benzene	5	0.64 J	0.52 J	ND	--	0.98 J	2.5	0.91 J	0.79 J
1,4-Dichlorobenzene	5	1.7 J	ND	5.4 J	--	17	68	21	22
1,3-Dichlorobenzene	5	ND	ND	ND	--	3.6	14	4.3	4.4
1,2-Dichlorobenzene	5	ND	ND	1.9 J	--	5.0	17	6.4	6
Isopropyl Benzene	5	0.29 J	ND	ND	--	0.63 J	7.1	2.6	2.5
1,2,4-Trichlorobenzene	5	ND	ND	ND	--	4.2	12	2.7	2.8
Chlorobenzene	5	ND	ND	ND	--	2.0	9.6	3.9	3.8
Napthalene	50	ND	ND	ND	--	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**359**	**297**	**280**	--	**198**	**302**	**131.8**	**138.5**
DCA/TCA Ratio	**--**	*6.1*	*4.5*	*4.7*	--	*6.8*	*16.7*	*18.4*	*22.1*
CA/DCA Ratio	**--**	*0.20*	*0.20*	*0.28*	--	*0.98*	*0.87*	*1.12*	*1.13*
CA/TCA Ratio	**--**	*1.22*	*0.89*	*1.32*		*6.69*	*14*	*21*	*25*
Dissolved Gases (µg/L)									
Methane	none	130 J	51 D	53 D	--	195 D	--	182 J	264 J
Ethane	none	ND	ND	ND	--	ND	--	ND	ND
Ethene	none	ND	ND	ND	--	ND	--	ND	ND
Dechlorinating Bacteria (cells/mL)									
Dehalococcoides sp.	none	2.70	--	12.3	--	--	--	50.2	--
Dehalobacter sp.	none	649	--	15.4	--	--	--	6,010	--
Metals (µg/L)									
Iron	300 (2)	2,610	1,180	2,370	--	5,380 J	--	1,460	1,400
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	2,600	--	--	--
Manganese	300 (2)	4,150	6,430	6,480	--	7,910	--	4,690	4,560
Wet Chemistry (mg/L)									
Nitrate (as N)	10	ND	--	--	ND	--	--	ND	ND
Nitrite (as N)	1	ND	--	--	ND	--	--	ND	ND
Chloride	250	4.26	--	--	3.54 J	--	--	3.0	2.97
Sulfide	none	ND	--	--	ND	--	--	ND	ND
TOC	none	1.3	43.69	31.3 J	--	26 J	1.9	1.7	1.6
Water Quality Parameters									
pH	none	6.67	6.54	7.37	5.85	5.84	6.13	7.30	--
Specific Conductivity (mS/cm)	none	0.162	0.148	0.123	0.140	0.183	0.149	0.110	--
Dissolved Oxygen (mg/L)	none	--	0.45	--	0	-- / 0.6	0 / 0.5	0 / 1.0	--
Temperature (°C)	none	13.78	15.72	11.2	11.31	10.55	14.07	13.09	--
Oxygen Reduction Potential (mV)	none	-398	22	-9	-13	119	44	-18	--
Turbidity (NTU)	none	0	0	1.51	2.00	0.8	0.35	0.87	--

Purpose / Notes		Downgradient Monitoring Well						Downgradient Monitoring Well				
Location	NYSDOH MCLs (1)	SA-PZ-160I (41-46 ft bgs)						SA-PZ-160I1 (33-38 ft bgs)				
Sample Date		7/7/2010	10/12/2010	12/13/2010	12/16/2010	3/8/2011	6/21/2011	7/6/2010	10/12/2010	12/13/2010	3/8/2011	6/21/2011
VOCs (µg/L)												
1,1,1-Trichloroethane (TCA)	5	53	37	41	--	30 J	14	43	40 J	39	47	16
1,1-Dichloroethane (DCA)	5	210	150 J	160	--	130	85	250	200	180	210	190
1,1-Dichloroethene (DCE)	5	17	11	11	--	9.3 J	4.8	17	15 J	13	17	13
Chloroethane (CA)	5	26	13 J	21	--	11 J	6	34	42 J	33	55	140
Benzene	5	0.48 J	ND	ND	--	ND	ND	0.5 J	0.51 J	ND	0.82 J	ND
1,4-Dichlorobenzene	5	ND	ND	ND	--	ND	ND	ND	ND	ND	5.2	ND
1,3-Dichlorobenzene	5	ND	ND	ND	--	ND	ND	ND	ND	ND	1.2	ND
1,2-Dichlorobenzene	5	ND	ND	ND	--	ND	ND	ND	ND	ND	2.2	5.2 J
Isopropyl Benzene	5	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	1.9 J	ND	ND	--	0.63 J	ND	ND	ND	ND	2.7	ND
Chlorobenzene	5	ND	ND	ND	--	ND	ND	ND	ND	ND	0.66 J	ND
Napthalene	50	4.5 J	ND	ND	--	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**306**	**211**	**233**	**--**	**180**	**110**	**344**	**297**	**265**	**329**	**359**
DCA/TCA Ratio	--	*4.0*	*4.1*	*3.9*	--	*4.3*	*6.1*	*5.8*	*5.0*	*4.6*	*4.5*	*12*
CA/DCA Ratio	--	*0.12*	*0.09*	*0.13*	--	*0.08*	*0.07*	*0.14*	*0.21*	*0.18*	*0.26*	*0.74*
CA/TCA Ratio	--	*0.49*	*0.35*	*0.51*		*0.37*	*0.43*	*0.79*	*1.05*	*0.85*	*1.17*	*8.75*
Dissolved Gases (µg/L)												
Methane	none	0.6	6.4	15	--	4.2	ND	--	--	--	--	--
Ethane	none	ND	ND	ND	--	ND	ND	--	--	--	--	--
Ethene	none	ND	ND	ND	--	ND	ND	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)												
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)												
Iron	300 (2)	1,520	38.7 J	--	3,340	8,060 J	11,800	--	--	--	--	2,300
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	2,600	--	--	--	--	2,200	--
Manganese	300 (2)	571	516	--	662	1,070	660	--	--	--	--	3,900
Wet Chemistry (mg/L)												
Nitrate (as N)	10	--	--	--	--	--	ND	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	ND	--	--	--	--	--
Chloride	250	--	--	--	--	--	7.6	--	--	--	--	--
Sulfide	none	--	--	--	--	--	ND	--	--	--	--	--
TOC	none	0.81 J	ND	16.8	--	2.8 J	1.1	--	--	--	--	--
Water Quality Parameters												
pH	none	6.05	5.78	7.42	5.88	6.36	7.74	6.17	6.15	6.06	6.08	5.70
Specific Conductivity (mS/cm)	none	0.133	0.093	0.106	0.118	0.155	0.119	0.115	0.110	0.124	0.157	0.106
Dissolved Oxygen (mg/L)	none	--	0.38	--	0	-- / 0.3	0 / 1.0	1.71	0.24	0	-- / 0.6	0.54 / 0.4
Temperature (°C)	none	14.10	13.0	11.8	10.87	10.8	13.26	13.97	13.0	11.56	11.03	15.3
Oxygen Reduction Potential (mV)	none	-111	151	-51	-18	49	-114	64	109	-75	78	-20
Turbidity (NTU)	none	3.04	0.31	0	1.98	0.82	0.71	1.56	0	0.33	0.85	0.27

Purpose / Notes		Downgradient Monitoring Well								Upgradient Monitoring Well		
Location	NYSDOH MCLs [1]	SA-PZ-161I (41-46 ft bgs)								SA-PZ-408 (37-42 ft bgs)		SA-TW-408 [4] (38-42 ft bgs)
Sample Date		7/7/2010	10/12/2010	12/14/2010	3/8/2011	3/8/2011 (duplicate)	6/21/2011	9/19/2011	9/19/2011 (duplicate)	6/22/2011	9/20/2011	6/10/2011
VOCs (µg/L)												
1,1,1-Trichloroethane (TCA)	5	100	18	16	26	30	35 J	6.5	6.6	ND	60	19
1,1-Dichloroethane (DCA)	5	530	110	97	140	140	290 J	88	83	160	420	190
1,1-Dichloroethene (DCE)	5	31	6.9	5.9	10	10	13 J	5.9	5.6	13	25	11
Chloroethane (CA)	5	51	9.5	8	9.5	11	16 J	8	8.2	130	230	110
Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	1.1
1,4-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.2	2.9
1,3-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	0.64 J
1,2-Dichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	1.2
Isopropyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.6	4.3
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	--	**712**	**144**	**127**	**186**	**191**	**354**	**108.4**	**103.4**	**303**	**735**	**330**
DCA/TCA Ratio	--	*5.3*	*6.1*	*6.1*	*5.4*	*4.7*	*8.3*	*13.5*	*12.6*	*--*	*7.0*	*10*
CA/DCA Ratio	--	*0.10*	*0.09*	*0.08*	*0.07*	*0.08*	*0.06*	*0.09*	*0.10*	*0.81*	*0.55*	*0.58*
CA/TCA Ratio	--	*0.51*	*0.53*	*0.50*	*0.37*	*0.37*	*0.46*	*1.23*	*1.24*	*--*	*3.83*	*5.79*
Dissolved Gases (µg/L)												
Methane	none	--	--	--	--	--	--	--	--	180	--	--
Ethane	none	--	--	--	--	--	--	--	--	ND	--	--
Ethene	none	--	--	--	--	--	--	--	--	ND	--	--
Dechlorinating Bacteria (cells/mL)												
Dehalococcoides sp.	none	--	--	--	--	--	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--	--	--	--	--	--
Metals (µg/L)												
Iron	300 [2]	--	--	--	--	--	11,800	--	--	1,400	--	--
Fe^{2+} (Ferrous Iron)	none	--	--	--	0	0	--	--	--	--	--	--
Manganese	300 [2]	--	--	--	--	--	2,770	--	--	5,000	--	--
Wet Chemistry (mg/L)												
Nitrate (as N)	10	--	--	--	--	--	--	--	--	1.13	--	--
Nitrite (as N)	1	--	--	--	--	--	--	--	--	ND	--	--
Chloride	250	--	--	--	--	--	--	--	--	5.21	--	--
Sulfide	none	--	--	--	--	--	--	--	--	ND	--	--
TOC	none	--	--	--	--	--	--	--	--	1.6	--	--
Water Quality Parameters												
pH	none	5.65	6.07	5.14	5.72	--	6.76	6.49	--	5.99	6.17	5.87
Specific Conductivity (mS/cm)	none	0.129	0.124	0.090	0.114	--	0.182	0.296	--	0.136	0.140	0.171
Dissolved Oxygen (mg/L)	none	0	0	--	-- / 1.0	--	0 / 0.2	0.75 / 0.0	--	0.98 / 1.0	0.41 / 0.20	2.99
Temperature (°C)	none	13.99	14.82	9.5	10.99	--	12.8	14.75	--	15.6	13.88	13.91
Oxygen Reduction Potential (mV)	none	4	168	142	128	--	-110	-61	--	14	135	29
Turbidity (NTU)	none	7.1	0	0	0.52	--	58.7	1.84	--	2.23	0.10	247

Purpose / Notes	NYSDOH MCLs (1)	Cross-gradient Reference Well					
Location		SA-MW-127I (36-46 ft bgs)					
Sample Date		7/30/2008	9/3/2009	9/16/2010	9/16/2010 (duplicate)	3/10/2011	9/22/2011
VOCs (µg/L)							
1,1,1-Trichloroethane (TCA)	5	94	61	1.2 J	1.1	8.1	4.1
1,1-Dichloroethane (DCA)	5	470	270 J	9.1 J	9.3	93	71
1,1-Dichloroethene (DCE)	5	27	20	ND	ND	5.6	3.8
Chloroethane (CA)	5	63	29	ND	ND	26	8.5
Benzene	5	1.0	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	5	13	3.8 J	ND	ND	ND	ND
1,3-Dichlorobenzene	5	3.0	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	5	3.0	ND	ND	ND	ND	ND
Isopropyl Benzene	5	1.0	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	5	4.0	2.7 J	ND	ND	ND	ND
Chlorobenzene	5	1.0	ND	ND	ND	ND	ND
Napthalene	50	ND	ND	ND	ND	ND	ND
Total Target VOCs (TCA, DCA, DCE, CA)	**--**	**654**	**380**	**10.3**	**10.4**	**132.7**	**87.4**
DCA/TCA Ratio	--	*5.0*	*4.4*	*7.6*	*8.5*	*11.5*	*17.3*
CA/DCA Ratio	--	*0.13*	*0.11*	--	--	*0.28*	*0.12*
CA/TCA Ratio	--	*0.67*	*0.48*	--	--	*3.21*	*2.07*
Dissolved Gases (µg/L)							
Methane	none	--	35	15	15	6.1 J	--
Ethane	none	--	ND	ND	ND	ND	--
Ethene	none	--	--	--	--	--	--
Dechlorinating Bacteria (cells/mL)							
Dehalococcoides sp.	none	--	--	--	--	--	--
Dehalobacter sp.	none	--	--	--	--	--	--
Metals (µg/L)							
Iron	300 (2)	--	--	--	--	--	--
Fe^{2+} (Ferrous Iron)	none	--	--	--	--	--	--
Manganese	300 (2)	--	--	--	--	--	--
Wet Chemistry (mg/L)							
Nitrate (as N)	10	--	--	--	--	--	--
Nitrite (as N)	1	--	--	--	--	--	--
Chloride	250	--	--	--	--	--	--
Sulfide	none	--	--	--	--	--	--
TOC	none	--	--	--	--	--	--
Water Quality Parameters							
pH	none	6.36	5.16	5.89	--	5.79	6.06
Specific Conductivity (mS/cm)	none	0.113	0.083	0.079	--	0.096	0.098
Dissolved Oxygen (mg/L)	none	0.44	0.19	0.25	--	-- /0.7	0.61 / 0.60
Temperature (°C)	none	13.6	13.07	13.0	--	6.09	13.85
Oxygen Reduction Potential (mV)	none	82	42	119	--	79	60
Turbidity (NTU)	none	1.35	0	0	--	1.44	0

Shading indicates exceedance of the NYSDOH MCL
ft bgs - feet below ground surface
J qualifier - Estimated Value
ND - Not detected
1. New York State (NYS) Department of Health (NYSDOH) Maximum Contaminant Level (MCL). 10 NYCRR, Part 5, Subpart 5-1 Public Water Systems, Tables 1 through 3. http://www.health.ny.gov/regulations/nycrr/title_10/part_5/sul
2. If iron and manganese are present, the total concentration of both should not exceed 500 μg/L.
3. Samples were diluted such that the concentrations of select chemicals (e.g., benzene, trichlorobenzenes and other aromatic compounds) may not have been detected at or above this limit and therefore were labeled as non-detects.
4. Vertical profile boring SA-TW-408 is located at a comparable screen depth (38-42 ft bgs) as SA-PZ-408, and is presented here to show a representative sample of the aquifer at this location and depth.
-- / 0.6 = DO probe reading/ field test kit reading
-- = Not Analyzed.

TABLE A-2
GROUNDWATER ANALYTICAL RESULTS - PUMPING TEST 1
SITE 6A-SOUTHERN AREA
NWIRP CALVERTON, NEW YORK

Parameter (ug/L)	USEPA MCL	NYSDEC MCL	Constant Rate Test			
			7/14/2010		7/15/2010	
			Initial	7-Hour	22-Hour	Final
METALS (ug/L)						
IRON	--	300	753 J	735 J	725 J	770 J
MANGANESE	--	300	**1,270**	**1,200**	**1,150**	**1,130**
VOLATILES (ug/L)						
1,1,1-TRICHLOROETHANE	200	5	2.9 J	3.5 J	3.5 J	3.4 J
1,1-DICHLOROETHANE	NA	5	16	18	18	19
1,1-DICHLOROETHENE	7	5	1.1 J	1.1 J	1.2 J	0.99 J
1,2,4-TRICHLOROBENZENE	70	5	0.68 J	5 U	5 U	5 U
1,2-DICHLOROBENZENE	600	3	0.39 J	5 U	5 U	5 U
1,4-DICHLOROBENZENE	75	3	5 U	5 U	0.42 J	0.4 J
2-BUTANONE	--	--	13 U	13 U	13 U	13 U
TOLUENE	1000	5	5 U	5 U	5 U	5 U

Notes
ug/L - micrograms per liter
MCL - maximum contaminant level
NYSDEC - New York State Department of Environmental Conservation
USEPA - United States Environmental Protection Agency
J - Estimated Value
U - not detected above associated value

APPENDIX B

AIR PERMITTING EVALUATION

CALCULATED MAXIMUM ANNUAL DAILY INFLUENT CONCENTRATIONS
FENCELINE GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE SYSTEM
NWIRP CALVERTON, NEW YORK

Chemical	CAS No.	Current Maximum Influent Concentration (g/m^3) (1)	Current Mean Influent Concentration (g/m^3) (1)	Calculated Maximum Annual Concentration (g/m^3) (2)
1,1,1-Trichloroethane	71-55-6	0.004	0.00017	63
1,1-Dichloroethane (3)	75-34-3	0.0169	0.00078	0.0077
1,1-Dichloroethene	75-35-4	0.001	0.00005	1
Chloroethane	75-00-3	0.0049	0.0002	122
Benzene	71-43-2	0.0001	0.000003	0.0024
1,4-Dichlorobenzene	106-46-7	0.0002	0.00002	0.0009
1,3-Dichlorobenzene	541-73-1	0.0001	0.000003	0.1974
1,2-Dichlorobenzene	95-50-1	0.0001	0.000005	3
Isopropyl Benzene	98-82-8	0.0002	0.00001	6
1,2,4-Trichlorobenzene	120-82-1	0.0002	0.00002	--

Notes:

(1) Maximum and mean concentrations values are calculated using both maximum and mean Design Influent Concentrations, as presented in Table 3-1: Design Parameters, from the Basis of Design Report for Fenceline Groundwater Extraction, Treatment, and Discharge System at Site 6A - Southern Area.

(2) Discharge Goals are based on a flow of 900 cfm, and are calculated from the Actual Annual % of AGCs from the DAR-1 Model Output to achieve air quality requirements. The summary of additional inputs for this model run is provided in the attached DAR-1 Model Output.

(3) Current Maximum Influent Concentrations were used in this DAR-1 Analysis to identify contaminants that may trigger future treatment. The maximum concentrations for 1,1-Dichloroethane would trigger a need for treatment of air emissions if influent concentrations of this chemical remained at this high level for daily operation for a full year. Influent concentrations of this chemical will need to be monitored during initial operation of the treatment system, but concentrations of this chemical are expected to be significantly lower than this maximum concentration towards the end of the first year of operation. Note that the Calculated Maximum Annual Concentration for this chemical does not exceed the Current Mean Influent Concentration, and therefore treatment of air emissions is not recommended.

Tetra Tech NUS		***STANDARD CALCULATION SHEET***	
CLIENT: US CLEAN	FILE No:	BY: SK	PAGE: 1 of
SUBJECT: Calculation of Influent Concentrations Fenceline Treatment System NWIRP Calverton, New York		CHECKED BY:	DATE: 3/20/2012

1. Purpose:

To calculate loading rates for target contaminants to be treated by the Fenceline Groundwater Extraction and Treatment System, for input into the DAR-1 Analysis.

2. Approach:

From a list of standard conversion factors and the influent maximum and mean (average) concentrations, calculate the influent loading rate in pounds per hour and pounds per day for target chemicals.

3. List and Calculate Conversion Factors:

Conversions and Constants:

Feed Water Flow: 100 gal/min

Air Flow: 900 ft^3/min

1	Liter	=	0.2642	gallons
1	microgram	=	0.000000001	kilograms
1	kilogram	=	2.2046	lbm
1	hr	=	60	minutes
1	year	=	525,600	minutes

4. Calculate loading rates in pounds per hour:

Chemical	CAS No.	Influent Concentration - Maximum (µg/L)	Influent Concentration - Mean (µg/L)	Influent Loading Rate - Maximum (lb/hr)	Influent Loading Rate - Mean (lb/hr)
1,1,1-Trichloroethane	71-55-6	260	11	0.013	0.0006
1,1-Dichloroethane	75-34-3	1,100	51	0.055	0.0026
1,1-Dichloroethene	75-35-4	65	3	0.003	0.0002
Chloroethane	75-00-3	320	13	0.016	0.0007
Benzene	71-43-2	4.4	0.2	0.0002	0.00001
1,4-Dichlorobenzene	106-46-7	16	1	0.001	0.0001
1,3-Dichlorobenzene	541-73-1	4	0.2	0.0002	0.00001
1,2-Dichlorobenzene	95-50-1	6.4	0.3	0.0003	0
Isopropyl Benzene	98-82-8	11	0.4	0.001	0
1,2,4-Trichlorobenzene	120-82-1	14	1	0.001	0.0001

Tetra Tech NUS		***STANDARD CALCULATION SHEET***	
CLIENT: US CLEAN	FILE No:	BY: SK	PAGE: 2 of
SUBJECT: Calculation of Influent Concentrations Fenceline Treatment System NWIRP Calverton, New York		CHECKED BY:	DATE: 3/20/2012

4. Calculate loading rates in pounds per year:

Chemical	CAS No.	Influent Concentration - Maximum (µg/L)	Influent Concentration - Mean (µg/L)	Influent Loading Rate - Maximum (lb/year)	Influent Loading Rate - Mean (lb/year)
1,1,1-Trichloroethane	71-55-6	260	11	114	4.82
1,1-Dichloroethane	75-34-3	1,100	51	482.4	22.37
1,1-Dichloroethene	75-35-4	65	3	28.5	1.32
Chloroethane	75-00-3	320	13	140.3	5.7
Benzene	71-43-2	4.4	0.2	1.9	0.09
1,4-Dichlorobenzene	106-46-7	16	1	7	0.44
1,3-Dichlorobenzene	541-73-1	4	0.2	1.8	0.09
1,2-Dichlorobenzene	95-50-1	6.4	0.3	2.8	0.13
Isopropyl Benzene	98-82-8	11	0.4	4.8	0.18
1,2,4-Trichlorobenzene	120-82-1	14	1	6.1	0.44

Tetra Tech NUS		***STANDARD CALCULATION SHEET***	
CLIENT: US CLEAN	FILE No:	BY: SK	PAGE: 3 of
SUBJECT: Calculation of Influent Concentrations Fenceline Treatment System NWIRP Calverton, New York		CHECKED BY:	DATE: 3/20/2012

1. Purpose:

To calculate influent concentrations for target contaminants to be treated by the Fenceline Groundwater Extraction and Treatment System, to verify previous analysis.

2. Approach:

From a list of standard conversion factors and the influent maximum and mean (average) concentrations, calculate the influent concentrations in parts per million by volume of air for target chemicals.

3. List and Calculate Conversion Factors:

Feed Water Flow:	100 gal/min	=	23	m^3/hr
Air Flow:	900 ft^3/min	=	1500	m^3/hr

1 cubic meter	=	264.17	gallons
1 hour	=	60	minutes
1 day	=	1440	minutes
1 microgram	=	0.000001	grams
1 cubic foot	=	0.0283	cubic meters
1 cubic meter	=	1,000	L
R	=	0.0000821	m^3atm/moleºK
T = 50 ºF	=	283.15	ºK
P	=	1	atmosphere

4. Convert Influent concentrations in µg/L to g/m^3

Chemical	CAS No.	Influent Concentration - Maximum (µg/L)	Influent Concentration - Mean (µg/L)	Influent Concentration - Maximum (g/m^3)	Influent Concentration - Mean (g/m^3)
1,1,1-Trichloroethane	71-55-6	260	11	0.004	0.00017
1,1-Dichloroethane	75-34-3	1,100	51	0.0169	0.00078
1,1-Dichloroethene	75-35-4	65	3	0.001	0.00005
Chloroethane	75-00-3	320	13	0.0049	0.0002
Benzene	71-43-2	4.4	0.2	0.0001	0.000003
1,4-Dichlorobenzene	106-46-7	16	1	0.0002	0.00002
1,3-Dichlorobenzene	541-73-1	4	0.2	0.0001	0.000003
1,2-Dichlorobenzene	95-50-1	6.4	0.3	0.0001	0.000005
Isopropyl Benzene	98-82-8	11	0.4	0.0002	0.00001
1,2,4-Trichlorobenzene	120-82-1	14	1	0.0002	0.00002

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CLIENT: US CLEAN	FILE No:	BY: SK	PAGE: 4 of
SUBJECT: Calculation of Influent Concentrations Fenceline Treatment System NWIRP Calverton, New York		CHECKED BY:	DATE: 3/20/2012

5. Calculate Chemical Concentration in Parts Per Million Volume from Concentration in g/m^3

Equation: PV = nRT or V = nRT/P

Chemical	CAS No.	Molecular Mass (grams per mole)	Influent Concentration - Maximum (ppmv)	Influent Concentration - Mean (ppmv)
1,1,1-Trichloroethane	71-55-6	133.4	0.697	0.0296
1,1-Dichloroethane	75-34-3	98.96	3.97	0.1832
1,1-Dichloroethene	75-35-4	96.94	0.2398	0.012
Chloroethane	75-00-3	64.51	1.7657	0.0721
Benzene	71-43-2	78.11	0.0298	0.0009
1,4-Dichlorobenzene	106-46-7	147	0.0316	0.0032
1,3-Dichlorobenzene	541-73-1	147	0.0158	0.0005
1,2-Dichlorobenzene	95-50-1	147	0.0158	0.0008
Isopropyl Benzene	98-82-8	120.19	0.0387	0.0019
1,2,4-Trichlorobenzene	120-82-1	181.45	0.0256	0.0026

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CLIENT: US CLEAN	FILE No:	BY: SK	PAGE: 5 of
SUBJECT: Calculation of Influent Concentrations Fenceline Treatment System NWIRP Calverton, New York		CHECKED BY:	DATE: 3/20/2012

1. Purpose:
To verify current discharge limits for for target contaminants to be treated by the Fenceline Groundwater Extraction and Treatment System.

2. Approach:
From the Contaminant Assessment Summary of the DAR-1 Model output for target contaminants (see DAR-1 output for analysis inputs), use the Actual Annual % of the Annual Guideline Concentration (AGC), a current average flow rate of 900 cubic feet per minute (cfm), and influent chemical emission rates in pounds per hour (lb/hour) and pounds per year (lb/year) to back calculate current discharge goals.

3. Calculation of Current Discharge Goals:

Chemical	Current Actual Annual % of AGC(1)	Current Maximum Concentration (g/m^3)(2)	Current Chemical Emission Rate Prior to Treatment (lb/hour)(3)	Current Chemical Emission Rate Prior to Treatment (lb/year)(3)	Calculated Discharge Goal (lb/hr)(4)	Calculated Discharge Goal (lb/year)(4)	Maximum Allowable Concentration (g/m^3)(4)
1,1,1-Trichloroethane	0.0064	0.0040	0.0135	118	211	1,800,000	63
1,1-Dichloroethane	215.8	0.0169	0.0569	499	0.026	231	0.0077
1,1-Dichloroethene	0.1147	0.0010	0.0034	30	3	30,000	1
Chloroethane	0.0040	0.0049	0.0165	145	413	3,600,000	122
Benzene	4.119	0.0001	0.0003	3	0.008	72	0.0024
1,4-Dichlorobenzene	21.92	0.0002	0.0007	6	0.003	27	0.0009
1,3-Dichlorobenzene	0.0507	0.0001	0.0003	3	0.665	10,000	0.1974
1,2-Dichlorobenzene	0.0039	0.0001	0.0003	3	9	100,000	3
Isopropyl Benzene	0.0034	0.0002	0.0007	6	20	200,000	6
1,2,4-Trichlorobenzene	0	0.0002	0.0007	6	--	--	--

Notes:

(1)Actual Annual % of the AGCs is from the attached DAR-1 Model Output.

(2)Values were taken from Table 3-1: Design Parameters of the Basis of Design Report for Fence Line Groundwater Extraction, Treatment, and Discharge System at Site 6A - Southern Area.

(3)Chemical Emission Rates were calculated from maximum concentrations and an average flow rate of 900 cfm.

(4)Discharge Goals are based on a flow of 900 cfm, and calculated from the Actual Annual % of the AGCs from the DAR-1 Model Output to achieve air quality requirements. The summary of additional inputs for this model run is provided in the DAR-1 Model Output. Stack height is 20 feet, and the property line was evaluated at a distance of 75 feet.

CALVERTON FENCELINE GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE SYSTEM AIR STRIPPER STACK EMISSIONS
DAR-1 MODEL OUTPUT, POINT SOURCE (STACK EMISSIONS) TYPE

I. Summary of Inputs for Model Run to Nearest Property Line (75 feet), worst case scenario (highest contaminant concentrations in groundwater)

Chemical	CAS No.	Influent Loading Rate - Maximum (lb/hr)	Influent Loading Rate - Maximum (lb/year)	Maximum Concentration of Untreated Off Gas[(1)] (g/m^3)
1,1,1-Trichloroethane[(2)]	71-55-6	0.013	114	0.004
1,1-Dichloroethane[(2)]	75-34-3	0.055	482.4	0.0169
1,1-Dichloroethene[(2)]	75-35-4	0.003	28.5	0.001
Chloroethane[(2)]	75-00-3	0.016	140.3	0.0049
Benzene	71-43-2	0.0002	1.9	0.0001
1,4-Dichlorobenzene	106-46-7	0.001	7	0.0002
1,3-Dichlorobenzene	541-73-1	0.0002	1.8	0.0001
1,2-Dichlorobenzene	95-50-1	0.0003	2.8	0.0001
Isopropyl Benzene	98-82-8	0.001	4.8	0.0002
1,2,4-Trichlorobenzene	120-82-1	0.001	6.1	0.0002

HA	Height Above stack/ maximum height of plume (HA, feet)	15
SH	Stack Height/Treatment Building Air Stack (SH, feet)	20
D	Stack Diameter (D, inches)	6
T	Stack Exit Temperature (T, degrees Fahrenheit)	50
V	Stack Exit Velocity (V, ft/sec)	76.4
Q[(3)]	Stack Exit Flow Rate [Q, Actual Cubic Feet per Minute (ACFM)]	900
Dpl	Shortest Distance from Source Building (Treatment Building) to Property Line (Dpl, feet) for point sources	75
BW	Building Width (BW, feet) of Source Building (Treatment Building) for point sources	25
BL	Building Length (BL, feet) of Source Building (Treatment Building)	35
Q	Actual Hourly Emission Rate (lbs/hour) for source contaminant	Chemical specific, see above
Qa	Actual Annual Emission Rate (lbs/year) for source contaminant	Chemical specific, see above

(1) Emission rates and maximum concentration values are calculated using both maximum and mean Design Influent Concentrations as presented in Table 3-1: Design Parameters from the Basis of Design Report for Fence Line Groundwater Extraction, Treatment, and Discharge System at Site 6A – Southern Area.

[(2)] Only the first four chemicals listed in the summary of inputs will have a full printout from the DAR-1 Analysis, provided in sections four through seven.
[(3)] "Q" is the design flow rate of 900 cubic feet per minute, but flow rates actual flow rates will be in the range of 600 to 900 cubic feet per minute.

II. Contaminant Assessment Summary of All Relevant Chemicals:

CONTAMINANT ASSESSMENT SUMMARY OF DAR-1 ANALYSIS 3/23/12
Page 1

CAS NUMBER	AGC ug/m3	SHORT-TERM MAXIMUM (Cav,Pt,Area) % OF SGC	CAVITY ACTUAL ANNUAL % OF AGC	POINT or AREA SOURCE POTENTIAL ANNUAL % OF AGC	POINT or AREA SOURCE ACTUAL ANNUAL % OF AGC
00071-43-2	0.13000000	0.0111	0.0000	3.7940	4.1192
00071-55-6	5000.00000000	0.1041	0.0000	0.0064	0.0064
00075-00-3	10000.00000000	0.0000	0.0000	0.0039	0.0040
00075-34-3	0.63000000	0.0000	0.0000	215.2921	215.8066
00075-35-4	70.00000000	0.0000	0.0000	0.1057	0.1147
00095-50-1	200.00000000	0.0007	0.0000	0.0037	0.0039
00098-82-8	400.00000000	0.0000	0.0000	0.0062	0.0034
00106-46-7	0.09000000	0.0000	0.0000	27.4008	21.9207
00120-82-1	****************	0.0195	0.0000	0.0000	0.0000
00541-73-1	10.00000000	0.0000	0.0000	0.0493	0.0507
SUMMARY TOTALS		0.1354	0.0000	246.6622	242.0296

Notes:
Current Maximum Influent Concentrations were used in this DAR-1 Analysis to identify contaminants that may trigger future treatment. The maximum concentrations for 1,1-Dichloroethane would trigger a need for treatment of air emissions if influent concentrations of this chemical remained at this high level for daily operation for a full year. Influent concentrations of this chemical will need to be monitored during initial operation of the treatment system, but concentrations of this chemical are expected to be significantly lower than this maximum concentration towards the end of the first year of operation. Note that the Calculated Maximum Annual Concentration for this chemical does not exceed the Current Mean Influent Concentration, and therefore treatment of air emissions is not recommended. See Table 1: Calculated Maximum Annual Daily Influent Concentrations for comparison.

III. Contaminant Impact Summary of All Relevant Chemicals:

CONTAMINANT IMPACT SUMMARY OF DAR-1 ANALYSIS 3/23/12
Page 1

CAS NUMBER	AGC ug/m3	SHORT-TERM MAXIMUM (Cav,Pt,Area) ug/m3	CAVITY ACTUAL ANNUAL ug/m3	POINT or AREA SOURCE POTENTIAL ANNUAL ug/m3	POINT or AREA SOURCE ACTUAL ANNUAL ug/m3
00071-43-2	0.13000000	0.144143149	0.000000000	0.004932147	0.005354903
00071-55-6	5000.00000000	9.369304660	0.000000000	0.320589572	0.321294164
00075-00-3	10000.00000000	11.531451200	0.000000000	0.394571781	0.395417292
00075-34-3	0.63000000	39.639366100	0.000000000	1.356340530	1.359581655
00075-35-4	70.00000000	2.162147280	0.000000000	0.073982209	0.080323541
00095-50-1	200.00000000	0.216214716	0.000000000	0.007398221	0.007891436
00098-82-8	400.00000000	0.720715702	0.000000000	0.024660736	0.013528175
00106-46-7	0.09000000	0.720715702	0.000000000	0.024660736	0.019728589
00120-82-1	****************	0.720715702	0.000000000	0.024660736	0.017192056
00541-73-1	10.00000000	0.144143149	0.000000000	0.004932147	0.005073066

IV. Contaminant Impact Summary Step by Step Menu for 1,1,1-Trichloroethane:

```
******************************************************************************

 NWIRP CALVERTON                CALVERTON, NEW YORK            SUFFOLK

EMISSION POINT =           TOTAL      CAS NUMBER = 00071-55-6      SIC =    0

   AGC =           5000.000000000 ug/m3         SGC =          9000.000000 ug/m3

   STACK: HA=      15., SH=    20., D=     6., T=     51., V=    76.40, q=     900.00
BUILDING: Dpl=       75., BW=    25., BL=    35., %CONTROL=    0.0000

**  Reported Hourly Emission Rate (Q) is equal to          0.013000000 lbs/hour.

**  Reported Annual Emission Rate (Qa) is equal to       114.000000 lbs/year.

II.B.   REFINED CAVITY IMPACT METHOD (DAR-1, APPENDIX B).

II.B.1.      Shortest Distance from building to Property Line (    75. feet )
             exceeds the cavity length, or 3 times the building height
             (    15. feet ).  Therefore, this buildings cavity impacts
             (if they occur) are confined to on site receptors.  Computer
             will assume the CAVITY Annual Impact equals 0.00 ug/m3.

II.C.   CAVITY Annual Impact (       0.000 ug/m3 ) is less than AGC
        (   5000.000 ug/m3 ).
```

```
III.A.   STANDARD POINT SOURCE METHOD (DAR-1, APPENDIX B).

III.A.1.c.         Buoyancy flux, F, is equal to       0.002 m(4)/sec(2).

III.A.1.d.         Effective stack height, he, is equal to      20.059 feet.

III.A.2.      STANDARD POINT SOURCE Actual Annual Impact is equal
              to       0.803 ug/m3 for  8769. hours/year of operation.

III.A.3.      STANDARD POINT SOURCE Potential Annual Impact is equal
              to       0.801 ug/m3 assuming 8,760 hours/year of operation.

III.A.4.b.         Stack height to building height ratio is greater than
                   2.5 (GEP stack).  Computer will multiply actual annual
                   & potential annual impacts by 0.4 factor.

III.A.5.      STANDARD POINT SOURCE Short-Term Impact is calculated below
              using the DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.

III.D.   STANDARD POINT SOURCE Actual Annual Impact (       0.321 ug/m3 ) is
         less than AGC (      5000.000 ug/m3 ).

III.D.   STANDARD POINT SOURCE Potential Annual Impact (       0.321 ug/m3 )
         is less than AGC (      5000.000 ug/m3 ).
```

```
         **** Potential Annual Impact is based upon 8760 hours/year          ****
         **** operation instead of reported 8769. hours/year.                ****

2.0      DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.
         See 'Technical Reference for the Screening Procedures of the
         DAR-1 Software Program, Wade/Sedefian,' 1/11/94.

2.2           CAVITY Short-Term Impact is equal to  0.00 ug/m3 as the plume
              escaped the cavity region:  hs(  20. feet) > hc(   5. feet).

II.C.    CAVITY Short-Term Impact (      0.000 ug/m3 ) is less
         than SGC (   9000.000 ug/m3 ).

2.3           Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

2.3           Effective stack height, he, is equal to     20.059 feet.

2.4           Maximum non-downwash GEP stack Short-Term Impact (CSTP) is equal
              to          9.369 ug/m3,  for   hs/hb =   4.00

III.D.   Maximum non-cavity Short-Term Impact (CST:         9.369 ug/m3 ) is
         less than the SGC (      9000.000 ug/m3 ) for the point source.
```

```
2.7           Maximum Short-Term cavity, point, or area source impact
              (SHORT-TERM MAXIMUM, (Cav,Pt,Area)) equals         9.369 ug/m3
              and is reported in the ANALYSIS MENU.  This value is less than
              the SGC (     9000.000 ug/m3 ).
```

V. Contaminant Impact Summary Step by Step Menu for 1,1-Dichloroethane:

```
******************************************************************************

 NWIRP CALVERTON                CALVERTON, NEW YORK            SUFFOLK

EMISSION POINT =            TOTAL     CAS NUMBER = 00075-34-3     SIC =    0

   AGC =              0.630000000 ug/m3        SGC =            0.000000 ug/m3

   STACK: HA=    15., SH=   20., D=    6., T=    51., V=   76.40, q=    900.00
BUILDING: Dpl=     75., BW=   25., BL=   35., %CONTROL=   0.0000

**  Reported Hourly Emission Rate (Q) is equal to         0.055000000 lbs/hour.

**  Reported Annual Emission Rate (Qa) is equal to       482.400000 lbs/year.

II.B.   REFINED CAVITY IMPACT METHOD (DAR-1, APPENDIX B).

II.B.1.      Shortest Distance from building to Property Line (   75. feet )
             exceeds the cavity length, or 3 times the building height
             (    15. feet ).  Therefore, this buildings cavity impacts
             (if they occur) are confined to on site receptors.  Computer
             will assume the CAVITY Annual Impact equals 0.00 ug/m3.

II.C.   CAVITY Annual Impact (      0.000 ug/m3 ) is less than AGC
        (      0.630 ug/m3 ).
```

```
III.A.   STANDARD POINT SOURCE METHOD (DAR-1, APPENDIX B).

III.A.1.c.        Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

III.A.1.d.        Effective stack height, he, is equal to     20.059 feet.

III.A.2.      STANDARD POINT SOURCE Actual Annual Impact is equal
              to       3.399 ug/m3 for  8771. hours/year of operation.

III.A.3.      STANDARD POINT SOURCE Potential Annual Impact is equal
              to       3.391 ug/m3 assuming 8,760 hours/year of operation.

III.A.4.b.        Stack height to building height ratio is greater than
                  2.5 (GEP stack).  Computer will multiply actual annual
                  & potential annual impacts by 0.4 factor.

III.A.5.      STANDARD POINT SOURCE Short-Term Impact is calculated below
              using the DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.

III.D.   STANDARD POINT SOURCE Actual Annual Impact (      1.360 ug/m3 ) is
         greater than AGC (        0.630 ug/m3 ).

         **** Refer to DAR-1 Section III.D.1.  A refined site         ****
         **** specific modeling analyis may be required.                    ****

III.D.   STANDARD POINT SOURCE Potential Annual Impact (      1.356 ug/m3 )
         is greater than AGC (        0.630 ug/m3 ).

         **** Potential Annual Impact is based upon 8760 hours/year        ****
         **** operation instead of reported 8771. hours/year.              ****

2.0      DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.
         See "Technical Reference for the Screening Procedures of the
         DAR-1 Software Program, Wade/Sedefian,' 1/11/94.

2.2           CAVITY Short-Term Impact is equal to  0.00 ug/m3 as the plume
              escaped the cavity region: hs(  20. feet) > hc(   5. feet).

II.C.    CAVITY Short-Term Impact is equal to       0.000 ug/m3.
         There is no SGC for this contaminant.

2.3           Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

2.3           Effective stack height, he, is equal to     20.059 feet.

2.4           Maximum non-downwash GEP stack Short-Term Impact (CSTP) is equal
              to         39.639 ug/m3,  for   hs/hb =    4.00

III.D.   Maximum non-cavity Short-Term Impact (CST) equals       39.639 ug/m3
         for the point source.  There is no SGC for this contaminant.

2.7           Maximum Short-Term cavity, point, or area source impact
              (SHORT-TERM MAXIMUM, (Cav,Pt,Area)) equals       39.639 ug/m3
              and is reported in the ANALYSIS MENU.
```

VI. Contaminant Impact Summary Step by Step Menu for 1,1-Dichloroethene:

```
*******************************************************************************

 NWIRP CALVERTON                 CALVERTON, NEW YORK            SUFFOLK

EMISSION POINT =            TOTAL     CAS NUMBER = 00075-35-4     SIC =    0

   AGC =             70.000000000 ug/m3         SGC =          0.000000 ug/m3

   STACK: HA=    15., SH=   20., D=    6., T=    51., V=   76.40, q=    900.00
BUILDING: Dpl=     75., BW=   25., BL=   35., %CONTROL=   0.0000

**  Reported Hourly Emission Rate (Q) is equal to        0.003000000 lbs/hour.

**  Reported Annual Emission Rate (Qa) is equal to       28.500000 lbs/year.

II.B.   REFINED CAVITY IMPACT METHOD (DAR-1, APPENDIX B).

II.B.1.      Shortest Distance from building to Property Line (   75. feet )
             exceeds the cavity length, or 3 times the building height
             (   15. feet ).  Therefore, this buildings cavity impacts
             (if they occur) are confined to on site receptors.  Computer
             will assume the CAVITY Annual Impact equals 0.00 ug/m3.

II.C.   CAVITY Annual Impact (      0.000 ug/m3 ) is less than AGC
        (     70.000 ug/m3 ).
```

```
III.A.  STANDARD POINT SOURCE METHOD (DAR-1, APPENDIX B).

III.A.1.c.        Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

III.A.1.d.        Effective stack height, he, is equal to     20.059 feet.

III.A.2.     STANDARD POINT SOURCE Actual Annual Impact is equal
             to       0.201 ug/m3 for  9500. hours/year of operation.

III.A.3.     STANDARD POINT SOURCE Potential Annual Impact is equal
             to       0.185 ug/m3 assuming 8,760 hours/year of operation.

III.A.4.b.        Stack height to building height ratio is greater than
                  2.5 (GEP stack).  Computer will multiply actual annual
                  & potential annual impacts by 0.4 factor.

III.A.5.     STANDARD POINT SOURCE Short-Term Impact is calculated below
             using the DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.

III.D.  STANDARD POINT SOURCE Actual Annual Impact (      0.080 ug/m3 ) is
        less than AGC (       70.000 ug/m3 ).

III.D.  STANDARD POINT SOURCE Potential Annual Impact (      0.074 ug/m3 )
        is less than AGC (       70.000 ug/m3 ).
```

```
          **** Potential Annual Impact is based upon 8760 hours/year          ****
          **** operation instead of reported 9500. hours/year.                ****

2.0       DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.
          See "Technical Reference for the Screening Procedures of the
          DAR-1 Software Program, Wade/Sedefian,' 1/11/94.

2.2             CAVITY Short-Term Impact is equal to  0.00 ug/m3 as the plume
                escaped the cavity region:  hs(  20. feet) > hc(   5. feet).

II.C.     CAVITY Short-Term Impact is equal to        0.000 ug/m3.
          There is no SGC for this contaminant.

2.3             Buoyancy flux, F, is equal to       0.002 m(4)/sec(2).

2.3             Effective stack height, he, is equal to      20.059 feet.

2.4             Maximum non-downwash GEP stack Short-Term Impact (CSTP) is equal
                to           2.162 ug/m3,  for    hs/hb =    4.00

III.D.    Maximum non-cavity Short-Term Impact (CST) equals          2.162 ug/m3
          for the point source.  There is no SGC for this contaminant.
```

```
2.7             Maximum Short-Term cavity, point, or area source impact
                (SHORT-TERM MAXIMUM, (Cav,Pt,Area)) equals         2.162 ug/m3
                and is reported in the ANALYSIS MENU.
```

VII. Contaminant Impact Summary Step by Step Menu for Chloroethane:

```
********************************************************************************

 NWIRP CALVERTON                CALVERTON, NEW YORK            SUFFOLK

EMISSION POINT =           TOTAL     CAS NUMBER = 00075-00-3     SIC =    0

   AGC =         10000.000000000 ug/m3        SGC =           0.000000 ug/m3

   STACK: HA=    15., SH=    20., D=     6., T=     51., V=    76.40, q=     900.00
BUILDING: Dpl=      75., BW=    25., BL=    35., %CONTROL=    0.0000

**  Reported Hourly Emission Rate (Q) is equal to          0.016000000 lbs/hour.

**  Reported Annual Emission Rate (Qa) is equal to       140.300000 lbs/year.

II.B.   REFINED CAVITY IMPACT METHOD (DAR-1, APPENDIX B).

II.B.1.      Shortest Distance from building to Property Line (    75. feet )
             exceeds the cavity length, or 3 times the building height
             (    15. feet ).  Therefore, this buildings cavity impacts
             (if they occur) are confined to on site receptors.  Computer
             will assume the CAVITY Annual Impact equals 0.00 ug/m3.

II.C.   CAVITY Annual Impact (       0.000 ug/m3 ) is less than AGC
        (  10000.000 ug/m3 ).
```

```
III.A.  STANDARD POINT SOURCE METHOD (DAR-1, APPENDIX B).

III.A.1.c.        Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

III.A.1.d.        Effective stack height, he, is equal to     20.059 feet.

III.A.2.     STANDARD POINT SOURCE Actual Annual Impact is equal
             to       0.989 ug/m3 for  8769. hours/year of operation.

III.A.3.     STANDARD POINT SOURCE Potential Annual Impact is equal
             to       0.986 ug/m3 assuming 8,760 hours/year of operation.

III.A.4.b.        Stack height to building height ratio is greater than
                  2.5 (GEP stack).  Computer will multiply actual annual
                  & potential annual impacts by 0.4 factor.

III.A.5.     STANDARD POINT SOURCE Short-Term Impact is calculated below
             using the DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.

III.D.  STANDARD POINT SOURCE Actual Annual Impact (      0.395 ug/m3 ) is
        less than AGC (    10000.000 ug/m3 ).

III.D.  STANDARD POINT SOURCE Potential Annual Impact (      0.395 ug/m3 )
        is less than AGC (    10000.000 ug/m3 ).
```

```
        **** Potential Annual Impact is based upon 8760 hours/year        ****
        **** operation instead of reported 8769. hours/year.              ****

2.0     DAR-1 SOFTWARE PROGRAM SHORT-TERM METHOD.
        See "Technical Reference for the Screening Procedures of the
        DAR-1 Software Program, Wade/Sedefian,' 1/11/94.

2.2          CAVITY Short-Term Impact is equal to  0.00 ug/m3 as the plume
             escaped the cavity region:  hs(  20. feet) > hc(   5. feet).

II.C.   CAVITY Short-Term Impact is equal to       0.000 ug/m3.
        There is no SGC for this contaminant.

2.3          Buoyancy flux, F, is equal to      0.002 m(4)/sec(2).

2.3          Effective stack height, he, is equal to     20.059 feet.

2.4          Maximum non-downwash GEP stack Short-Term Impact (CSTP) is equal
             to         11.531 ug/m3,  for   hs/hb =    4.00

III.D.  Maximum non-cavity Short-Term Impact (CST) equals       11.531 ug/m3
        for the point source.  There is no SGC for this contaminant.
```

```
2.7          Maximum Short-Term cavity, point, or area source impact
             (SHORT-TERM MAXIMUM, (Cav,Pt,Area)) equals       11.531 ug/m3
             and is reported in the ANALYSIS MENU.
```

VIII. Contaminant Summary AGCs and SGCs for All Relevant Chemicals:

AGCs & SGCs

3/23/12
Page 1

CAS NUMBER	CONTAMINANT NAME	SGC ug/m3	HOW	AGC ug/m3	HOW	TOX	CODES
00071-43-2	BENZENE	1300.00000	D	0.130000000	E	H	U HA
00071-55-6	METHYL CHLOROFORM	9000.00000	E	5000.000000000	E	L	HI
00075-00-3	ETHYL CHLORIDE	0.00000		10000.000000000	E	L	HI
00075-34-3	DICHLOROETHANE,1,1	0.00000		0.630000000	D	L	U HI
00075-35-4	VINYLIDENE CHLORIDE	0.00000		70.000000000	D	M	HI
00095-50-1	DICHLOROBENZENE, O-	30000.00000	Z	200.000000000	H	M	I
00098-82-8	CUMENE	0.00000		400.000000000	E		H
00106-46-7	DICHLOROBENZENE,P-	0.00000		0.090000000	D	M	U HI
00120-82-1	TRICHLORO BENZENE	3700.00000	Y	9999999.000000000	X		HC
00541-73-1	DICHLOROBENZENE, m-	0.00000		10.000000000	H	M	

IX. Contaminant Emissions Summary All Relevant Chemicals:

CONTAMINANT EMISSIONS SUMMARY

3/23/12
Page 1

CAS NUMBER	CONTAMINANT NAME	NUM. OF EPs PER CONTAM.	EMISSIONS (lbs/hour)	EMISSIONS (lbs/year)
00071-43-2	BENZENE	1	0.0002000	1.90000
00071-55-6	METHYL CHLOROFORM	1	0.0130000	114.00000
00075-00-3	ETHYL CHLORIDE	1	0.0160000	140.30000
00075-34-3	DICHLOROETHANE,1,1	1	0.0550000	482.40000
00075-35-4	VINYLIDENE CHLORIDE	1	0.0030000	28.50000
00095-50-1	DICHLOROBENZENE, O-	1	0.0003000	2.80000
00098-82-8	CUMENE	1	0.0010000	4.80000
00106-46-7	DICHLOROBENZENE,P-	1	0.0010000	7.00000
00120-82-1	TRICHLORO BENZENE	1	0.0010000	6.10000
00541-73-1	DICHLOROBENZENE, m-	1	0.0002000	1.80000
SUMMARY TOTALS		10	0.0907000	789.60000

APPENDIX C

PROCESS CALCULATIONS

C-1
Hydraulic Calculations

Extraction Well Self Priming Pump Calculation

Slab Elevation	39.00			
P atmos	33.00	ft (water)		
Static water level in well	32.00	EL		
Drawdown (during pumping)	5.00	feet		
Water level in well during pumping	27.00	EL		
Pump suction CL above slab	1.50	ft +/-		
Center line of Pump EL	40.50			
Suction Lift	13.50	ft		
Height of discharge line	10.00	ft		
Total static head	23.50	ft		

Suction Piping

Length of suction piping	120	feet		
Number of elbows	8	K =	0.54	cameron hydraulic data
Foot valve	0		0	psi for opening (Chemline Footvalve)

Discharge Piping

Length of discharge piping	30	feet		
Number of elbows	8	K =	0.54	cameron hydraulic data
Check Valve	1		1.4	psi for opening (Chemline Checkvalve)
Flow Throttling Valve	TBD			
Flow Meter	Mag flow meter			

Applying Hazen williams for the puspose of making calcs more automated
hf = 0.002083 x L x (100/C)^1.85 x (q^1.85) / (d^4.8655)
Assume plastic pipe C = 140

Water Temperature 60 F
Vapor pressure 0.6 ft of water

The system has been setup so that one pump can operate at 100 gpm OR two pumps will operate so that each pump's output is 70 gpm.

Schedule 40 PVC	**Suction Pipe**								**Discharge Pipe**						
Flow; gpm	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Foot Valve (3-inch)	Total Friction Loss, ft	NPSHA	NPSHR	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Check Valve (3-inch)	Total Friction Loss, ft	TDH, ft
70	3.068	3.0	1.5	0.6	0.00	2.1	16.79	5	3.068	3.0	0.4	0.6	3.23	4.2	29.8
100	3.068	4.3	2.9	1.3	0.00	4.1	14.76	7	3.068	4.3	0.7	1.3	3.23	5.2	32.9

Pump Data Sheet - Gorman-Rupp IND 60Hz

Company: Tetra Tech
Name: Shiva Kumar
Date: 8/30/2011

GORMAN-RUPP PUMPS

Pump:

Size: 03B-B-1
Type: 0&30-SERIES
Synch speed: Adjustable
Curve: 03B-B-1
Specific Speeds:
Dimensions:

Speed: 3290 rpm
Dia: 5 in
Impeller: 5633-A
Ns: —
Nss: —
Suction: 3 in
Discharge: 3 in

Search Criteria:

Flow: 100 US gpm
Head: 72.5 ft

Fluid:

Water
SG: 0.998
Viscosity: 1.269 cP
NPSHa: 26.2 ft
Temperature: 50 °F
Vapor pressure: 0.1781 psi a
Atm pressure: 14.64 psi a

Pump Limits:

Temperature: —
Pressure: —
Sphere size: —
Power: —
Eye area: —

Motor:

Standard: NEMA
Enclosure: TEFC
—
Speed: —
Frame: —
Sizing criteria: Max Power on Design Curve

---- Data Point ----

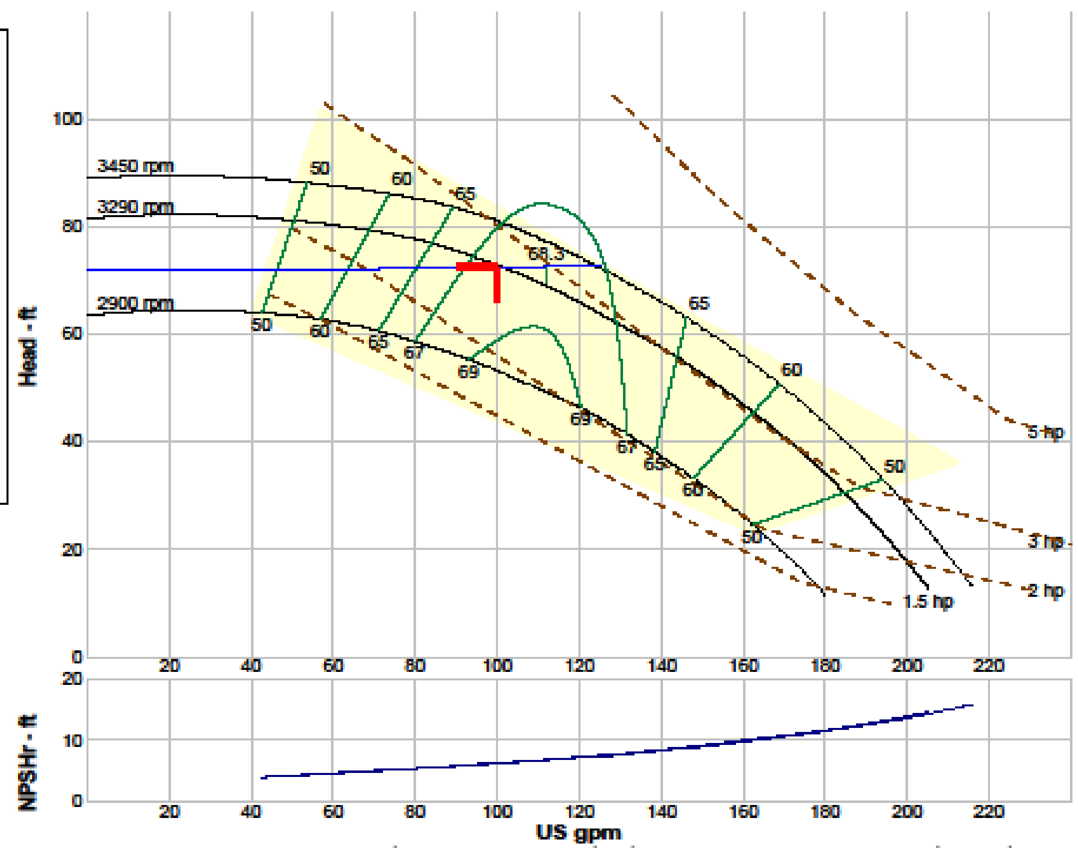
Flow:	100 US gpm
Head:	72.7 ft
Eff:	67%
Power:	2.71 hp
NPSHr:	6.37 ft

---- Design Curve ----

Shutoff head:	81.6 ft
Shutoff dP:	35.2 psi
Min flow:	—
BEP:	68% @ 112 US gpm
NOL power:	3.11 hp @ 144 US gpm

-- Max Curve --

Max power:
3.6 hp @ 169 US gpm



This curve is provided for preliminary selection only. Please consult factory before making final pump or motor selections.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
120	3290	65.8	68	2.93	7.34
100	3290	72.7	67	2.71	6.37
80	3290	77.6	64	2.45	5.5
60	3290	80.3	55	2.18	4.74
40	3290	81.3	44	1.93	3.98

Selected from catalog: Gorman-Rupp Industrial Pumps.60 Vers: 4.64

Injection Well Pump Calculation

Slab Elevation	39.00			
P atmos	33.00	ft (water)		
Static water level in well	32.00	EL		
Water rise (during pumping)	3.00	feet		
Water level in well during pumping	35.00	EL		
Water Level above slab	1.50	ft +/-		
Water Level above slab	40.50			
Total static head	-5.50	ft	-ve since water is pumped downgradient;	

<u>Suction Piping</u>

Length of piping	20	feet		
Number of elbows	4	K =	0.54	cameron hydraulic data

<u>Discharge Piping</u>

Length of discharge piping	600	feet		
Number of elbows	20	K =	0.54	cameron hydraulic data
Check Valve	1	1.4	psi for opening (Chemline checkvalve)	
Pressure drop across dirty bag filter	10	psi		
pressure drop across clean filter	3	psi		

Applying Hazen williams for the puspose of making calcs more automated
hf = 0.002083 x L x (100/C)^1.85 x (q^1.85) / (d^4.8655)
Assume plastic pipe C = 140

Water Temperature	60	F
Vapor pressure	0.6	ft of water

Two injection pumps (1 duty + 1 standby) will be provided so that each can operate at 100 to 140 gpm.
The pumps will be provided with a VFD to maintain a constat level in the A/S sump.

Schedule 80 PVC	Suction Pipe					Discharge Pipe							
Flow; gpm	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Total Friction Loss, ft	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Check Valve (3-inch)	**Bag filter pressure loss (max), ft**	Total Friction Loss, ft	TDH, ft
70	2.9	3.4	0.3	0.4	0.7	2.9	3.4	9.8	1.9	3.23	23.03	38.0	33.2
100	2.9	4.9	0.6	0.8	1.4	2.9	4.9	18.9	4.0	3.23	23.03	49.1	45.1
140	2.9	6.8	1.2	1.6	2.7	2.9	6.8	35.2	7.8	3.23	23.03	69.3	66.5

Schedule 80 PVC	Suction Pipe					Discharge Pipe							
Flow; gpm	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Total Friction Loss, ft	Pipe dia, inch	Velocity, ft/sec	Friction loss of straight pipe (ft)	Friction loss for elbows	Check Valve (3-inch)	**Bag filter pressure loss (Min), ft**	Total Friction Loss, ft	TDH, ft
70	2.9	3.4	0.3	0.4	0.7	2.9	3.4	9.8	1.9	3.23	6.91	21.9	17.1
100	2.9	4.9	0.6	0.8	1.4	2.9	4.9	18.9	4.0	3.23	6.91	33.0	28.9
140	2.9	6.8	1.2	1.6	2.7	2.9	6.8	35.2	7.8	3.23	6.91	53.1	50.4

C-2
Bag Filter Dirt Holding Capacity

Dirt Holding Capacity of Filter

LR-6		
Number of housings	2	
Number of filters	6	
Dirt holding capacity of one filter	1.75	kg/filter
Net dirt holding capacity per housing	10.5	kg/housing
Fe(III)	1200	ug/l
Fe(OH)3	2.29	mg/l
Flow	100	gpm
Fe(OH)3 removed in a day	1.25	kg/day
Number of days Filter will last	16.8	days

	MW
Fe	56
O	16
H	1
Mn	55

Multi-Round
Liquid
BAG HOUSINGS

Multi-Round Liquid Bag Housings effectively remove dirt, pipe scale, and other contaminants from process liquids. Quality construction and design assure clean effluent and protection for all downstream equipment.

APPLICATIONS

- Chemical
- General Industrial
- Oil and Gas
- Water

HOUSING OPERATION

Unfiltered liquid enters the housing above the filter bags or strainer baskets, fills the interior of the housing and continues through the bag or strainer basket. Solids are trapped inside the filter bags or strainers and easily removed when the housing is serviced. Our standard o-ring seal between the baskets and the housing ensures a positive seal to prevent bypass.

HOUSING OPTIONS

- 300 PSI pressure rating
- Mesh-lined strainer baskets
- Alternative o-ring materials
- Heavy-duty support legs

FEATURES

- Flow rates up to 3500 gpm
- Two basket to 17 basket housing designs, depending upon the required surface area and volume of fluid to be filtered
- Carbon steel and 304, or 316 Stainless Steel material
- Each vessel is factory hydro-tested
- Low pressure drop
- Swing bolts with bearing-assisted davit closure
- Buna-N® seals — lid and basket
- Differential, drain, and vent ports
- 316 Stainless Steel strainer baskets
- Two-part epoxy finish on carbon vessels
- Accepts #2-size bag filters
- Hydraulic lid lift

SPECIFICATIONS

Model	Maximum Dimensions
Pressure Rating	150 PSI at 300°F (up to 300 PSI optional)
Connections	2-, 3-, 4-, 6-, 8-, 10- or 12-inch RF FLG
Housing Lid	Swing bolts with davit cover lift
Lid & Basket Seals	Buna-N®
Pressure Ports	Two differential ports measure pressure across filter bag
Construction/Finish	Carbon steel w/two-part epoxy finish; 304 or 316 Stainless Steel w/satin finish
Basket Material	316 Stainless Steel with 9/64-inch perforations
Bags Sizes	#2 liquid bags accepted
Base	Heavy duty support legs

Pentair Industrial

Pleated Series Filter Bags

ORDERING INFORMATION

Custom configurations available; please contact Customer Service.

KE 1 - PL K 2

PLEATED SERIES	MICRON RATING	STYLE	CONSTRUCTION	SIZE
KE = Polyester Felt	1	Pleated = PL	Outer Cage = K	1
KO = Polypropylene Felt	5			2
	10			4
	25			8
	50			9
	75			
	100			
	200			

LIQUID BAG SQUARE FOOTAGE

Size	Pleated	Standard
#1	9.0	2.0
#2	19.0	4.4
#4	2.5	1.0
#8	8.0	2.0
#9	13.0	3.4

Pentair Industrial
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support@pentairindustrial.com www.pentairindustrial.com

Printed in USA AP08 380095

C-3
Polyphosphate Dosing Requirements

Polyphosphate Dosing

Design Fe + Mn conc.	2.7	mg/L
Calcium Conc	6	mg/L
Plant Flow	100	gpm
Plant Flow	378.5	lpm
Dose	4.5	mg/l
Polyphosphate Mass Flo	1703.25	mg/min
Specific Gravity	1.37	
Density	1.37	kg/l
Solution (%)	35	%
Polyphosphate Flow	479.5	mg/ml
Polphosphate Flow	3.6	ml/min
Polphosphate Flow	1.4	GPD
Monthly Usage	41	Monthly usage rate (gal)

CARUS™ 8100 WATER TREATMENT CHEMICAL
EC- SAFETY DATA SHEET according to EC directive 2001/58/EC
MATERIAL SAFETY DATA SHEET

MSDS # CP-356 **Revision Date: October 2007** **Supercedes: June 2006**

Section 1 Chemical Product and Company Identification

Product Name: CARUS™ 8100 Water Treatment Chemical **Trade Name:** CARUS™ 8100 Water Treatment Chemical **Synonyms:** Blended Phosphate solution	
Manufacturer's Name: Carus Phosphates, Inc.	**Information:** (815) 223-1500 (815) 224-6816 (FAX) www.caruschem.com (Web) salesmkt@caruschem.com (Email)
Manufacturer's Address: Carus Phosphates, Inc. 315 Fifth Street Peru, IL 61354, USA	**Emergency Telephone:** (800) 435 -6856 (USA) (815) 223-1500 (Other countries) CHEMTREC® (800) 424-9300 (USA) (703) 527-3887 (Other countries)

Section 2 Ingredients Information

Material	PEL	TLV	CAS.NO.	EC. NO.	%
Triphosphoric acid, pentasodium salt	No Data	No Data	7758-29-4	231-838-7	1-15
Non-hazardous ingredients	No Data	No Data	N/A	N/A	85-99

This product contains no toxic chemicals subject to the reporting requirements of Section 313 – Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

All the components in this product are generally considered to be safe and none could be classified as hazardous according to the WHMIS system. None are listed on the Canadian Ingredient Disclosure List.

Carcinogenicity:	Not listed by NTP			
Hazard Symbols:	None			
Risk Phrases:	22	Harmful if swallowed.	38	Irritating to skin
Safety Phrases:	2	Keep out of reach of children	61	Avoid releases to the environment.

Section 3 Hazards Identification

Hazardous Materials Identification System (HMIS) Ratings:
Health: 1 - Slight
Flammability: 0 - None
Reactivity: 0 - None
Personnel Protective Equipment: goggles, face shield, apron, respirator and proper gloves.

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

Ingestion:
Phosphates are slowly and incompletely absorbed when ingested, and seldom result in systemic effects. Such effects, however, have occurred. Symptoms may include vomiting, lethargy, diarrhea, blood chemistry effects, heart disturbances and central nervous system effects. The toxicity of phosphates is due to their ability to sequester calcium.

Skin Contact:
May cause irritation. May cause inflammation and pain on prolonged contact, especially with moist skin.

Eye Contact:
May cause irritation, redness and pain.

Chronic Exposure:
May sequester calcium and cause calcium phosphate deposits in the kidneys.

Aggravation of Pre-existing Conditions:
No information found.

Section 4 First Aid Measures

Eyes:
Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface.
Skin:
Immediately wash contaminated areas with water. Remove contaminated clothing and footwear. Wash clothing and decontaminate footwear before reuse.
Inhalation:
Remove person from contaminated area to fresh air.
Ingestion:
Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water or milk. Seek medical attention immediately.

Section 5 Fire Fighting Measures

NFPA* Hazard Ratings:
Health: 1 = Materials which under fire conditions would give off irritating combustion products (less than 1 hour exposure). Materials which on the skin could cause irritation.
Flammability: 0 = Materials that will not burn.
Reactivity: 0 = Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.
Special Hazard: None
***National Fire Protection Association 704**
First Responders:
Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach incident with caution.

Flash Point	None
Flammable or Explosive Limits	Lower: Nonflammable Upper: Nonflammable
Extinguishing Media	Use large quantities of water. Dike to contain.

Section 6 Accidental Release Measures

Steps To Be Taken If Material Is Released Or Spilled:
Contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Absorb with inert media and dispose of properly. Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to phosphates. Flush area with large amounts of water.
Personnel Precautions:
Personnel should wear protective clothing suitable for the task.

Section 7 Handling and Storage

Work/Hygiene Practices:
Wash hands thoroughly with soap and water after handling phosphate solution, and before eating or smoking. Wear proper protective equipment. Remove clothing, if it becomes contaminated.
Ventilation Requirements:
Provide sufficient mechanical and/or local exhaust.

Conditions For Safe Storage:

Protect containers from physical damage. Store in a cool, dry area in closed containers.

Section 8 Exposure Controls and Personal Protection

Respiratory Protection:
In cases where overexposure to mist may occur, use an approved NIOSH-MSHA mist respirator (N-95 or better). Engineering or administrative controls should be implemented to control mist.

Eye:
Face shield, goggles, or safety glasses with side shields should be worn. Provide eyewash in working area.

Gloves:
Rubber or plastic gloves should be worn.

Other Protective Equipment:
Normal work clothing covering arms and legs, and rubber, or plastic apron should be worn. Caution: If clothing becomes contaminated, wash off immediately.

Section 9 Physical and Chemical Properties

Appearance And Odor:	Colorless solution, odorless
Boiling Point, 760 mm Hg:	>101 °C
Freezing Point:	< 0 °C
Vapor Pressure (mm Hg):	N/A
Solubility In Water % By Solution:	Miscible in all proportions
Percentage Volatile By Volume:	55% (as water)
Evaporation Rate:	Same as water
Specific Gravity:	1.37 ± 0.03
pH:	4.5 ± 0.5

Section 10 Stability and Reactivity

Stability:	Under normal conditions, the material is stable.
Conditions To Avoid:	Do not expose to extreme temperatures.
Incompatible Materials	Soluble calcium salt solutions and hydrofluoric or hydrofluosilicic acid could cause precipitations.
Hazardous Decomposition:	When involved in a fire, the material may form toxic fumes of phosphorous oxides.
Condition Contributing To Hazardous Polymerization:	Material is not known to polymerize.

Section 11 Toxicological Information

Acute Overexposure:
Irritating to body tissue with which it comes into contact.

Chronic Overexposure:
No known cases of chronic poisoning due to phosphate solutions have been reported. May sequester calcium and cause calcium phosphate deposits in the kidneys.

Carcinogenicity:
None of the components have been classified as a carcinogen by OSHA, NTP, and IARC.

Medical Conditions Generally Aggravated by Exposure:
Phosphate solution will cause further irritation of tissue, open wounds, burns or mucous membranes.

Section 12 Ecological Information

None

Section 13 Disposal Considerations

Waste Disposal:
Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to phosphates. Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 Transport Information

Not regulated by US DOT, Canada TDG, UN, IMDG, IATA regulations

Section 15 Regulatory Information

US Federal Regulations
TSCA:
All components in this product are listed on the TSCA inventory.
Health & Safety Reporting List:
None of the chemicals in this product are on the Health & Safety Reporting List.
Chemical Test Rules:
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b:
None of the chemicals in this product are listed under TSCA Section 12b.
TSCA Significant New Use Rule:
None of the chemicals in this product have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs:
None of the chemicals in this product have an RQ.
SARA Section 302 Extremely Hazardous Substances:
None of the chemicals in this product have a TPQ.
SARA Codes:
Acute
Section 313:
None of chemicals in this product are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 or Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
State:
None of the chemicals in this product are present on state lists from CA, PA, WI, MA, or NJ.

California Prop 65:
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives:

Hazard Symbols:	None			
Risk Phrases:	22	Harmful if swallowed.	38	Irritating to skin
Safety Phrases:	2	Keep out of reach of children	61	Avoid releases to the environment.

WGK (Water Danger/Protection): None

Canada - DSL/NDSL:
All components are listed on Canada's DSL List
Canada – WHMIS:
None of the components in this product could be classified as hazardous in accordance with the hazard criteria of the Controlled Products Regulations.
Canadian Ingredient Disclosure List:
None of the components in this product are listed on the Canadian Ingredient Disclosure List.

Section 16 Other Information

NIOSH:	National Institute for Occupational Safety and Health
MSHA:	Mine Safety and Health Administration
OSHA:	Occupational Safety and Health Administration
NTP:	National Toxicology Program
IARC:	International Agency for Research on Cancer
PEL:	Permissible Exposure Limit
DSL/NDSL:	The Domestic Substances and the Non-Domestic Substances List (Canada)
TLV-TWA:	Threshold Limit Value-Time Weighted Average
CAS:	Chemical Abstract Service
EINECS:	Inventory of Existing Chemical Substances (European) (EC. No.)

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Chithambarathanu Pillai

October 2007

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Good Chemistry at Work

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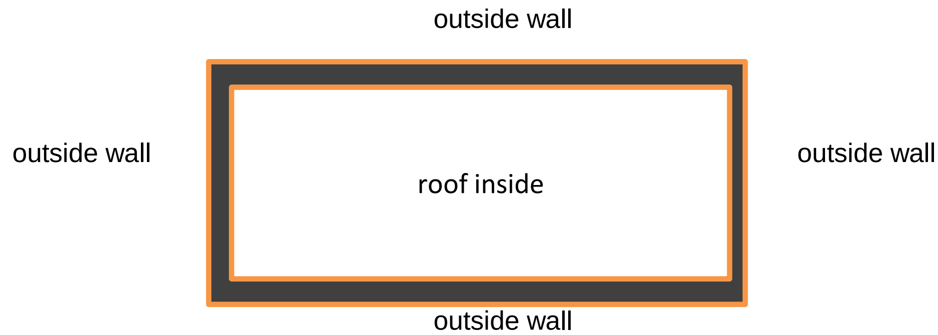
C-4
Treatment Building Heating Requirements

Treatment Building Heating Requirements

Design Indoor temp	59	F	ASHRAE
Design Outdoor temp	9	F	ASHRAE (97.5% for Bridgeport, CT)



Peak Height	14	ft	
Width (1 sidewall)	25	ft	
Length (1 end wall)	35	ft	
Exposed Wall Area	1680	ft2	
U, wall	0.113	btu/hr-ft2-F	(R-13)
Wall Subtotal	9,492	Btu/hr	
Roof Area	875		
U, roof	0.167	btu/hr-ft2-F	(R-13)
Roof subtotal	7306		
Ventilation Rate	NA	cfm/ft2 floor	
Floor area	NA	ft2	
Room air turnovers (minutes/change)	20		
Ventilation Make-up rate	613	cfm	Make-up air from outside building
Ventilation Subtotal Heat Required	33,688	Btu/hr	Heat Required =1.1 x cfm exhausted x (design inside T - design outside T)
Total Building Heat Required	**50,486**	**Btu/hr**	
	14.8	**kW**	

Prepared by	Revision	Date	Checked By:
WLS	A	11/17/2011	
DDB	B	5/9/2012	

C-5
Electrical Load List & Short Circuit Calculation

TETRA TECH	Proj. No.:	112G02750	Date:	4/18/2012
	Customer:	Naval Facilities Engineering Command ~ Mid-Atlantic	Revision:	B
	Project:	Groundwater Treatment Plant		
	Location:	Grumman Rd Calverton NY Suffolk County, New York		
	Purpose:	Preliminary Short Circuit Calculation		

SHORT CIRCUIT CALCULATION (PRELIMINARY)

T-1 TRANSFORMER
150KVA
480/277 VAC Secondary
3 Phase

STEP 1: Determine transformer full-load amperes.

$$I_{FLA} = \frac{KVA \times 1000}{E_{L\text{-}L} \times 1.732}$$

KVA = 150
$E_{L\text{-}L}$ = 480

I_{FLA} = 180 A

STEP 2: Find transformer multiplier.

$$\text{Multiplier} = \frac{100}{\text{Transf. } \%Z}$$

%Z = 1.20 Assumed %Z of "1.2" (150kVA Transformer impedance) for calculation.
Reference COOPER Bussman Bulletin EPR-1 "Electrical Plan Review"
Table 5 Short-Circuit Currents Available from Various Size Transformers

Multiplier = 83.33

STEP 3: Determine transformer let-through short circuit current for 3 Phase faults.

$I_{SCA\ (L\text{-}L\text{-}L)} = I_{FLA} \times$ Multiplier I_{FLA} from STEP 1, Multiplier from STEP 2

$I_{SCA\ (L\text{-}L\text{-}L)}$ = 15,036 Amps

** Utility voltages may vary +/- 10% for power; therefore for worst case condition multiply by 1.1*

$I_{SCA\ \text{with voltage variance}}$ = 16,539 Amps

*** Add in motor short-circuit contribution; for practical estimate multiply the total motor full-load amperes by 4*

$I_{SCA\ \text{motor contribution}}$ = 50 x 4 = 200 A

$I_{SCA\ \text{total}} = I_{SCA\ \text{with voltage variance}} + I_{SCA\ \text{motor contribution}}$

$I_{SCA\ \text{total}}$ = 16,739 Amps

STEP 4: Calculate "f" factor for 3 Phase faults.

$$f = \frac{1.732 \times L \times I_{L\text{-}L\text{-}L}}{C \times n \times E_{L\text{-}L}}$$

Where:

L = length (feet) of conduit to fault.

C = conductor constant. *Obtained from COOPER Bussman Bulletin EPR-1 "Electrical Plan Review", Table 2 "C" values for conductors

n = number of conductors per phase (Adjusts C value for parallel runs)

I = available short-circuit current in amperes at beginning of circuit.

L =	100	ft.	For prelim. short circuit calculation; length (L) to fault is assumed to be 100 feet
C =	8,925		3 single conductors, 600V, steel conduit, #1/0 AWG
n =	1		1 set of conductors per phase
I =	16,739	A	$I_{SCA\ total}$ from STEP 3
E =	480	V	

Then:

f = 0.677

STEP 5: Calculate "M" (multiplier).

$$M = \frac{1}{1 + f}$$

M = 0.596

STEP 6: Calculate the available short-circuit current (RMS symmetrical).

$I_{SCA\ (at\ fault)} = I_{SCA\ (at\ beginning\ of\ circuit)} \times M$ $\qquad I_{SCA\ total}$ from STEP 3, M from STEP 5

$I_{SCA\ (at\ fault)}$ = 9,983 Amps

NOTES:

1. Short circuit calculation assumes unlimited primary short-circuit current (infinite bus).
2. Utility Company transformer not selected, therefore a transformer impedance (%Z) of "1.2" was assumed for calculation.
3. Utility Company transformer location not set, therefore length of service entrance conductors in STEP 4 above are approximate.

Prepared by:		Checked by:		Approved by:	
Bill Stonebraker	4/18/2011				
Name	Date	Name	Date	Name	Date

				MOTOR						POWER DEVICES					kWH SUBTOTALS				
ITEM	DESCRIPTION	VOLT	Ø	HP	BHP	FLA	FEEDER FLA	kVA	kW	STARTER	MCP	DRIVE (VFD)	BREAKER (80% rated type)	% DEMAND	24Hr	MONTH	YEAR	NOTES	MINIMUM FEEDER (Reference Only - Installing Contractor to Verify)
		460	3																
CP-AS200	Air Stripper System Control Panel (Vendor Pkg)	460	3				40	31.87	27.09				150/50	100	500.6	15,017.9	182,717.2	2 - 5HP, 1 - 7.5HP & Control Power	3/4"C, 3-#8, 1-#10G
		460	3																
P-110	Groundwater Extraction Pump	460	3	5	3.9	6.26		4.99	4.24	1	15A			100	78.3	2,349.9	28,590.5		3/4"C, 4-#12
P-120	Groundwater Extraction Pump (SPARE)	460		5						1	15A			100				SPARE	
		460	3																
RD-1	Roll-up Door	460	3				1.6	1.27	1.08				150/15	100	20.0	600.7	7,308.7		3/4"C, 4-#12
F-1	Treatment Building Exhaust Fan	460	3	1	0.8	1.25		1.00	0.85	1	3A			100	15.7	470.0	5,718.1		3/4"C, 4-#12
		460	3																
T-1	15kVA Transformer 480-240/120 1 Phase	460	3				31.2	24.86	21.13				150/40	100	390.5	11,713.9	142,519.4		3/4"C, 3-#8, 1-#10G
		460	3																
H-1	Treatment Building Heater (15KW Unit)	460	3				18	14.34	12.19				150/30	100	225.3	6,758.0	82,222.7		3/4"C, 4-#10
		460	3																
	SPARE Breaker	460	3				15	11.95	10.16				150/20					SPARE Breaker	3/4"C, 4-#12
		460	3																
	FUTURE Motor - Size 1 FVNR Starter	460	3	5	3.9	6.26		4.99	4.24	1	15A							SPARE Starter	3/4"C, 4-#12
		460	3																
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Tetra Tech, NUS

LOW VOLTAGE MOTOR LIST

							MAINS FEEDER (Installing Contractor to Verify)	1 1/4"C, 3-#2, 1-#4G	1 1/2"C, 3-1/0, 1-#4G	+25%		PAGE 1/1	
PROJECT:	Calverton Treatment Plant Design	FILE:	MCC-TB Motor List	ISSUE:	Apr. 19 2012	0.85	PF	95.26	3Ø kVA	BALANCED kVA	95.26		+25%
NO:	112G02750	DATE:	Nov. 17 2011	REV:	B	0.88	EFF		1Ø kVA	BALANCED AMPS	119.57		+25%
ITEM:	MCC-TB (Treatment Building)						COST/kWH	95.26	CONNECTED kVA	MAIN, FRAME/TRIP (80%)	150/150		+25%

	24Hr	MONTH	YEAR
TOTAL Kwh	1,230.3	36,910.4	449,076.6
TOTAL $			

FORMULAS USED IN THIS SPREADSHEET

$$FLA = \frac{HP \times 746}{E \times \%EFF \times PF \times 1.732}$$

$$kVA = \frac{E \times I \times 1.732}{1000}$$

$$kW = \frac{E \times I \times PF \times 1.732}{1000}$$

GENERAL:

1. **DO NOT** enter two values (HP and FEEDER FLA) on the same line as both will calculate
2. Valid voltage range is 440-480V, user-selected
3. Power factor (PF), efficiency (EFF), COST/kWH, % DEMAND and phase (Ø) are user-defined. Some of these have typical or default values inserted
4. All single phase equipment is placed on the same phase and balanced on the other two phases
5. Feeder breaker sizing is based on 100% FLA and 80% trip
6. Main breaker sizing is based on 100% (standard) and 125% (+25%) BALANCED AMPS and 80% trip. If the amp are less than 100 or more than 1600, UNDER or OVER, respectively, appears in the MAIN BREAKER cell
7. **MINIMUM** feeder sizing is based on 125% FLA and type THHN cabling

ADDING MOTORS: enter horsepower value into HP column

1. Valid entries are 1/4 - 400HP **3-phase only**
2. Motor BHP, FLA, kVA, kW, NEMA starter size, MCP amps and **MINIMUM** FEEDER sizing is calculated for each entry
3. If the controller is a drive, softstart or similar device instead of a starter, enter VFD, IGBT, SOFT etc into the DRI column located under the POWER DEVICES heading. This will cause the STARTER and MCP cells for that iten blank

ADDING FEEDERS: enter amp value into FEEDER FLA column

1. Valid for feeds to 320A (equivalent to 400A 80% breaker)
2. Select 1 or 3Ø
3. KVA, kW, required feeder BREAKER and **MINIMUM** FEEDER sizing will be calculated for each entry

BLOCKING an item from calculation

1. Deleting the value in the Ø column for a given item will exclude that load from the calculated total while allowing t required starter, MCP, breaker etc to remain. An application for this would be the installed spare or standby unit in a pair of pumps. Optional to clearing the Ø value, a description such as SPARE or SBY may be used with the same result

kWH TOTALS:

1. Enter a run-time percentage for each item into the % DEMAND column
2. A daily, monthly and yearly kWH SUBTOTAL will be calculated for each item
3. Daily, monthly and yearly TOTAL kWH will be calculated
4. If kWH costing information is desired, enter a cost/kWH into the COST/kWH cell; total daily, monthly and yearly operating costs will be calculated

Treatment Building Miscellaneous Loads for 120/240V Distribution Panel PDP-1

Lighting Loads:

Ref. NEC, 2011, Article 220.12, Table 220.12

Equip. #	Description	Length (ft)	Width (ft)	Area (ft^2)	Occupancy Unit Load (VA / ft^2)		Connected Load (KVA)	Demand Factor	Demand in KVA
	Buiding Interior	35	25	875	2.00		1.75	1.0	1.75
	Building Exterior						0.50	0.6	0.30
							0.00	1.0	0.00
						Subtotal	2.25		2.05

Non-Lighting Loads:

Ref. NEC, 2011, Article 220.14 (A) thru (L)

Recpt. Type	Qty.	VA (each)		Connected Load (KVA)	Demand Factor	Demand in KVA
Duplx.	4	180		0.72	1.0	0.72
Quad.	2	360		0.72	1.0	0.72
					Receptacle Total	1.44
					Up to 1st 10 KVA @ 100%	1.44
					Overage	0.00
					Overage @ 50%	0.00
					Subtotal	1.44

Specific Loads and Motors:

Equip. #	Description	Volts	Amps	Phase		Connected Load (KVA)	Demand Factor	Demand in KVA
P-500	Sump Pump (1/2 HP)	120	9.8	1		1.18	0.6	0.71
P-510	Dosing Pump #1 (1/6 HP)	120	4.4	1		0.53	0.6	0.32
P-520	Dosing Pump #2 (1/6 HP)	120	4.4	1		0.53	0.6	0.32
	Control Panel Power	120	16	1		1.92	1.0	1.92
	Misc. Equipment	120	16	1		1.92	1.0	1.92
	Emergency Lights	120	1	1		0.12	1.0	0.12
						0.00	0.6	0.00
					Single Phase Subtotal	6.19		5.30
					Totals	10	KVA	7 KVA
					Amps @ 480V	12		9
			Transformer T-1:		Size	15.0	KVA	15.0 KVA
					% Loaded	66%		49%

C-6
Stormwater Design Calculations

Abbreviated Stormwater Management Report for the proposed

Calverton Fenceline Groundwater Treatment Facility

Grumman Blvd, Calverton, New York

Prepared by: Tetra Tech, April 2012, CSG/YL

The Navy is proposing a small groundwater treatment plant size and minor land improvements (mainly a gravel driveway). The majority of property (168.9 acres) remains the same except the minor disturbance of the subject project area. The site disturbance is 0.16 acres (6,800 s.f.) and the increase of impervious area within the disturbance area is approximately 30%.

The stormwater design for this site meets the intent of the Town of Riverhead's stormwater management (SWM) regulations, which, in general, refer to New York State DEC SWM guidelines. Therefore, the site stormwater management practices (SMP) design is based on New York State Stormwater Management Design Manual (August 2010) for stormwater quality. The SMP design parameters constitute the removal efficiency equivalent to the Department's performance criteria (80% TSS removal and 40% phosphorus removal). The site incurs less than 1 acre of disturbance, therefore the stormwater quantity control was not considered for the site development.

Infiltration practices were considered on this site to capture and temporarily store the WQv before allowing it to infiltrate into the soil. According to the USDA Soil Survey of Suffolk County, New York, the project site is located in a "CpC- Carver and Plymouth sands" Area, Hydrologic Soil Group (HSG) "A" and the capacity of the most limiting layer to transmit water (Ksat) is moderately high to high (0.20 to 5.95 in/hr), which is good for infiltration practices and the test borings confirmed the soil type. However, stormwater infiltration testing was not performed for the site.

During the test borings for foundation, the groundwater was encountered at approximately 4.5 to 5.0 feet below existing ground surfaces. Groundwater elevations fluctuate seasonally and are subject to variations of precipitation. It was assumed that the ground water is at 4.0 below the ground surface. Infiltration trench and dry well are not feasible on site due to the shallow ground water location.

Shallow Infiltration Basin is designed to store the WQv in a shallow depression area. A depression area (210 cubic feet, 35' long x 6' wide x 1' deep) is proposed adjacent to the existing wetlands.

Lined channels with a check dam at the end are planned for pretreatment measure from the roof drains to the infiltration basin. Vegetative cover similar to the existing conditions (turf grass mixed with brush/clump grass) will be established between the contributing pervious drainage area and the infiltration facility.

See attached excel work sheet for the Water Quality Volume (WQv) calculations

Infiltration Practices must be 25' from Structures

<u>Infiltration Basin:</u>

Note:

NYS Stormwater Management Design Manual Method (August 2003):

Find Req'd Volume:

$$WQ_v = \frac{(P)(R_v)(A)}{12}; R_v = 0.05 + 0.009\,(I)$$

P	1.25	(Figure 4.1, NYS Stormwater Management Design Manual)
I	100%	(impervious area)
Rv	0.95	
A	0.0489	(acres)
WQv	0.0048	(acre-feet)
WQv	211	(cubic feet, storage required)

Basin Sizing:

Length	35	(feet)
Width	6	(feet)
Depth	1	(feet)
Actual Volume:	210	(cubic feet)

Pre-Treatment:

Use a plunge pool (or similar) due to surface and groundwater constraints

C-7
Infiltration Trench Calculations

Sizing of Infiltration Gallery

Parameter	Value	Unit
Hydraulic Conductivity - Horizontal	221	feet/day
Hydaulic Conductivity - Vertical	102	feet/day
Hydraulic Gradient of Aquifer (foot-V/foot-H)	0.003	3-ft/1,000-ft
Hydraulic Gradient - Assuming deep groundwater:	1	1-ft/1-ft
Aquifer Thickness	45	feet
Groundwater rise allowed	2	feet
Specific Capacity of Injection Well	21	GPM/foot
Treated water flowrate (influent to infiltration gallery)	100	gpm
Quantity of groundwater to be infiltrated on a daily basis:	144,000	Gal/day
	19,251	Cubic Ft/day
Capacity of 200 foot trench:		
Vertical Infiltration Area required	0.94	feet
Vertical Gradient Required at Edge of Trench (south only)	0.009	foot/foot
Vertical Gradient Required at a distance of 100 feet (east/west/south)	0.005	foot/foot
Vertical Gradient Required at a distance of 200 feet (east/west/south)	0.003	foot/foot
Capacity of Injection Well	42	GPM

APPENDIX D

SOIL TESTING REPORT

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NWIRP Calverton
PROJECT NUMBER: 112G02750
DRILLING COMPANY: Delta Well and Pump
DRILLING RIG: Failing F-10

BORING No.: CA-SAFL-SB01
DATE: 10/17/2011
GEOLOGIST: Robert Sok
DRILLER: Bob Devine

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1	6 / 8					Dk Brn	Topsoil 0-6"; to Clayey F. sand, little clay, trace silt			-	-	-	-
S-1	2	8 / 7	16	11/24		very stiff	Org Brn			moist	-	-	-	-
	3	10 / 9						2" - F to Med gravel zone at 2.3-2.5 ft		moist	-	-	-	-
S-2	4	11 / 12	20	17/24		Med-Dense	Lt Brn	Silty Sand, F. to Med Sand, some silt, trace F. gravel			-	-	-	-
	5	6 / 9									-	-	-	-
S-3	6	9 / 7	18	8/24		Med-Dense				water at ~5' BGS	-	-	-	-
	7	5 / 7					Brn Tan	F. to Med Sand, trace C. Sand and gravel, trace silt, wet			-	-	-	-
S-4	8	6 / 6	13	8/24		Med-Dense				wet saturated	-	-	-	-
	9	4 / 4								poor recovery	-	-	-	-
S-5	10	8 / 8	12	3/24		Med-Dense	Tan Brn	F. to Med Sand, little silt, wet		wet saturated	-	-	-	-
	11													
	12													
	13													
S-6	14	5 / 5					Tan Brn	Same as above; except less silt		poor recovery	-	-	-	-
	15	7 / 10	12	2/24		Med-Dense				wet saturated	-	-	-	-
	16													
	17													
	18													
S-7	19	6 / 4					Brn Tan	Same as above		poor recovery	-	-	-	-
	20	4 / 5	8	2/24		Loose				wet saturated	-	-	-	-
	21													
	22													
	23													
S-8	24	7 / 5					Brn Tan	Assumed same as above			-	-	-	-
	25	4 / 7	9	NR		Loose				no recovery	-	-	-	-

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
No heaving observed during drilling, poor recoveries below water table

Drilling Area Background (ppm): NA

Converted to Well: Yes ______ No X ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME:	NWIRP Calverton	BORING No.:	CA-SAFL-SB02
PROJECT NUMBER:	112G02750	DATE:	10/17/2011
DRILLING COMPANY:	Delta Well and Pump	GEOLOGIST:	Robert Sok
DRILLING RIG:	Failing F-10	DRILLER:	Bob Devine

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1	5 / 6					Dk Brn	Topsoil 0-7"; Silty Clay,some silt, trace VF. To F. sand			-	-	-	-
S-1	2	7 / 8	12	22/24		stiff	Brn				-	-	-	-
	3	8 / 7					Brn			moist	-	-	-	-
S-2	4	7 / 6	14	18/24		stiff	Org Brn	2" - F to Med gravel zone at 3.5-3.7 ft			-	-	-	-
	5	5 / 4						F-C Sand, trace to little silt and clay, trace gravel		poor recovery	-	-	-	-
S-3	6	8 / 10	12	1/24		Med-Dense	Tan Brn			water at ~4-5' BGS	-	-	-	-
	7	7 / 8						F. to Med Sand, some silt and clay, wet			-	-	-	-
S-4	8	10 / 9	18	8/24		Med-Dense	Tan Brn			wet saturated	-	-	-	-
	9	6 / 7									-	-	-	-
S-5	10	8 / 8	15	9/24		Med-Dense	Tan Brn	F. to Med Sand, trace silt and clay, wet		wet saturated	-	-	-	-
	11													
	12													
	13													
S-6	14	5 / 4					Tan	No Sample		no recovery	-	-	-	-
	15	4 / 6	8	NR		Loose					-	-	-	-
	16													
	17													
	18													
S-7	19	3 / 4					Tan	F. to Med Sand, trace silt and clay, wet			-	-	-	-
	20	4 / 3	8	14/24		Loose				wet saturated	-	-	-	-
	21													
	22													
	23													
S-8	24	7 / 8					Tan	F. Sand, trace Med sand and silt, wet			-	-	-	-
	25	9 / 11	17	12/24		Med-Dense				wet saturated	-	-	-	-

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger

Drilling Area Background (ppm): NA

Converted to Well: Yes ____ No X ____ Well I.D. #: ____

Calverton Geotech Sampling Breakdown
Southern Area Treatment Building
October 17, 2011

BORING	Depth to	from	Time	Grain size	Moisture Content	% passing 200	Attenberg Limits
CA-SAFL-SB01	1	2	1215		X	X	
CA-SAFL-SB01	2	3	1217		X	X	
CA-SAFL-SB01	3	4	1220	X	X		
CA-SAFL-SB01	4	6	1224		X	X	
CA-SAFL-SB01	6	8	1227	X	X		
CA-SAFL-SB01	8	10	1234		X	X	
CA-SAFL-SB01	13	15	No Sample				
CA-SAFL-SB01	18	20	1250		X	X	
CA-SAFL-SB01	23	25	No Sample				
CA-SAFL-SB02	1	3	1410		X	X	X
CA-SAFL-SB02	3	4	1412		X	X	
CA-SAFL-SB02	4	6	1416		X	X	
CA-SAFL-SB02	6	8	1418	X	X		
CA-SAFL-SB02	8	10	1422		X	X	
CA-SAFL-SB02	13	15	No Sample				
CA-SAFL-SB02	18	20	1440	X	X		
CA-SAFL-SB02	23	25	1455		X	X	

Bob Devine

GeoTesting
EXPRESS

125 Nagog Park
Acton, MA 01720
978 635 0424 Tel
978 635 0266 Fax

Transmittal

TO:
David Brayack
Tetra Tech NUS, Inc.
Twin Oaks I, Suite 309
5700 Lake Wright Drive
Norfolk, Virginia 23502

DATE: 10/28/2011	GTX NO: 11233
RE: NWIRP Calverton Geotech, CTO WE63	

COPIES	DATE	DESCRIPTION
	10/28/2011	**October 2011 Laboratory Test Report**

REMARKS:

CC:

SIGNED: Joe Tomei
Joe Tomei, Laboratory Manager

APPROVED BY: Nancy J. Hubbard
Nancy Hubbard, Project Manager

GeoTesting
EXPRESS

Boston
Atlanta
New York
www.geotesting.com

October 28, 2011

David Brayack
Tetra Tech NUS, Inc.
Twin Oaks I, Suite 309
5700 Lake Wright Drive
Norfolk, Virginia 23502

RE: Contract Task Order (CTO) WE63
NWIRP Calverton Geotech, Calverton, NY (GTX-11233)

Dear David:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received 14 samples from you on 10/19/2011. These samples were labeled as follows:

CA-SAFL-SB01-0102
CA-SAFL-SB01-0203
CA-SAFL-SB01-0304
CA-SAFL-SB01-0406
CA-SAFL-SB01-0608
CA-SAFL-SB01-0810
CA-SAFL-SB01-1820
CA-SAFL-SB02-0103
CA-SAFL-SB02-0304
CA-SAFL-SB02-0406
CA-SAFL-SB02-0608
CA-SAFL-SB02-0810
CA-SAFL-SB02-1820
CA-SAFL-SB02-2325

GTX performed the following tests on these samples:

10 ASTM D 1140 - Percent Finer Than #200 Sieve
14 ASTM D 2216 - Moisture Contents
4 ASTM D 422 - Grain Size Analyses (sieve only)
1 ASTM D 4318 - Atterberg Limits

Moisture Content (ASTM D 2216)

Moisture content testing was performed in general accordance with ASTM D 2216. This test determines the water (moisture) content of a material by oven drying. The loss of mass caused by drying is due to the loss of water. The water content is defined as the ratio of the mass of water contained in the pore spaces of soil or rock material, to the mass of solid particles in that material, which is expressed as a percentage. A standard temperature of $110 \pm 5°C$ was used to determine the dry mass of the material.

GeoTesting Express, Inc. | 125 Nagog Park | Acton, MA 01720 | Toll Free 800 434 1062 | Fax 978 635 0266

Percent Passing No. 200 Sieve (ASTM D 1140)

Percent Passing No. 200 Sieve testing was performed in general accordance with ASTM D 1140. The test measures the percent of the soil sample which is finer than the No. 200 sieve size (75 µm). The sample is oven-dried and then washed over a No. 200 sieve until the wash water is clear. The material retained on the No. 200 sieve is then oven-dried and the percent of the original dry weight passing the No. 200 sieve is then calculated.

Grain Size Analysis (ASTM D 422)

Grain Size Analysis testing was performed in general accordance with ASTM D 422. The test measures the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 µm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75 µm is determined by a sedimentation process, using a hydrometer.

Atterberg Limits (ASTM D 4318)

Atterberg Limits testing was performed in general accordance with ASTM D 4318. The test includes the determination of the liquid limit, plastic limit, and the plasticity index of soils. The liquid limit represents the water content of a soil at the boundary between the semi-liquid and plastic states of a soil. The plastic limit is the water content of a soil at the boundary between the plastic and semi-solid states. The plasticity index is the range of water content over which a soil behaves plastically. Numerically, it is the difference between the liquid limit and the plastic limit.

Atterberg limit samples were prepared using the wet preparation method on specimens that were processed to remove any material coarser than a No. 40 sieve.

The liquid limit is determined by spreading a portion of the specimen in a brass cup, divided in two by a grooving tool, and then allowed to flow together from the shocks caused by repeatedly dropping the cup in a standard mechanical device.

Liquid limits were performed using Method A, the multipoint test, which requires three or more trials over a range of water contents to be performed and the data from the trials plotted to make a relationship from which the liquid limit is determined.

When requested, the oven-dried liquid limit was also determined. This test follows the same procedures as listed above for liquid limits. The difference is that the material is oven dried and then re-wet before the test is performed. If this value of liquid limit is less than 75% of the original liquid limit, the sample is considered to be organic.

The plastic limit is determined by rolling a small portion of soil into a thread and working the thread until its water content is reduced to a point at which a 1/8 in. diameter thread crumbles and can no longer be pressed together and re-rolled. The water content of the soil at this point is reported as the plastic limit.

GeoTesting Express, Inc. | 125 Nagog Park | Acton, MA 01720 | Toll Free 800 434 1062 | Fax 978 635 0266

A copy of your test request is attached.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Joe Tomei
Laboratory Manager

GeoTesting Express, Inc. | 125 Nagog Park | Acton, MA 01720 | Toll Free 800 434 1062 | Fax 978 635 0266

125 Nagog Park
Acton, MA 01720
978 635 0424 Tel
978 635 0266 Fax

Geotechnical Test Report **10/28/2011**

GTX-11233
NWIRP Calverton Geotech

Calverton, NY

Client Project No.: 112G02750; CTO WE63

Prepared for:

Tetra Tech NUS, Inc.

GeoTesting EXPRESS

Client:	Tetra Tech NUS, Inc.				
Project:	NWIRP Calverton Geotech				
Location:	Calverton, NY			Project No:	GTX-11233
Boring ID:	---	Sample Type:	---	Tested By:	jef
Sample ID:	---	Test Date:	10/28/11	Checked By:	jdt
Depth :	---	Sample Id:	---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	CA-SAFL-SB01-0102	---	Moist, dark brown silty sand	17.5
---	CA-SAFL-SB01-0203	---	Moist, brownish yellow silty sand	11.7
---	CA-SAFL-SB01-0304	---	Moist, brownish yellow sand with silt	10.7
---	CA-SAFL-SB01-0406	---	Moist, yellowish brown sand	24
---	CA-SAFL-SB01-0608	---	Moist, yellowish brown sand with silt	22.2
---	CA-SAFL-SB01-0810	---	Moist, brownish yellow sand with gravel	26.5
---	CA-SAFL-SB01-1820	---	Moist, light brown sand	29.3

Notes: Temperature of Drying : 110° Celsius

GeoTesting EXPRESS

Client:	Tetra Tech NUS, Inc.		
Project:	NWIRP Calverton Geotech		
Location:	Calverton, NY	Project No:	GTX-11233
Boring ID: ---	Sample Type: ---	Tested By:	jef
Sample ID:---	Test Date: 10/28/11	Checked By:	jdt
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	CA-SAFL-SB02-0103	---	Moist, olive yellow clayey sand	14.3
---	CA-SAFL-SB02-0304	---	Moist, brownish yellow sand with silt and gravel	11.5
---	CA-SAFL-SB02-0406	---	Moist, brownish yellow sand with silt	30.4
---	CA-SAFL-SB02-0608	---	Moist, brownish yellow sand with silt	18.7
---	CA-SAFL-SB02-0810	---	Moist, light yellow sand	21.7
---	CA-SAFL-SB02-1820	---	Moist, light yellowish brown sand	23.2
---	CA-SAFL-SB02-2325	---	Moist, light gray sand with gravel	21.7

Notes: Temperature of Drying : 110° Celsius

GeoTesting EXPRESS

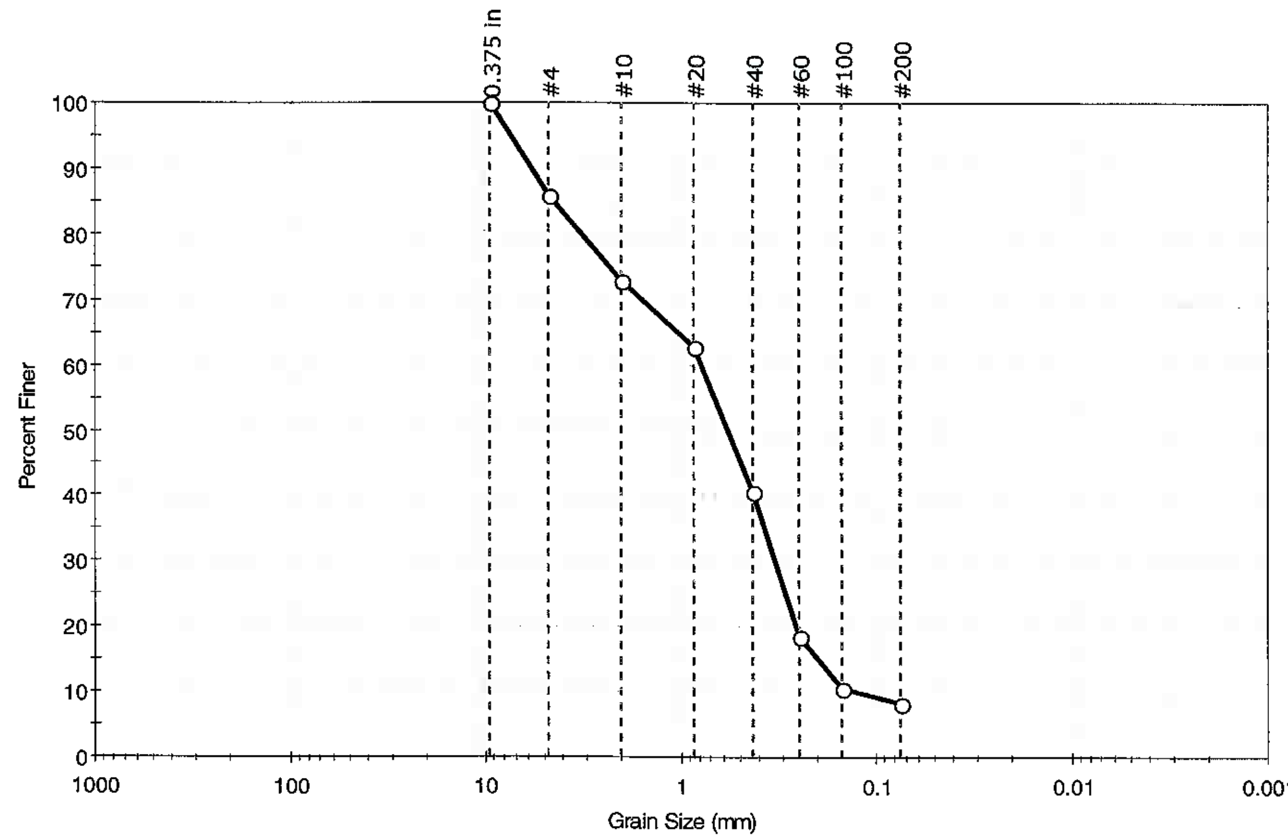
Client:	Tetra Tech NUS, Inc.		
Project:	NWIRP Calverton Geotech		
Location:	Calverton, NY	Project No:	GTX-11233
Boring ID: ---	Sample Type: ---	Tested By:	jbr
Sample ID:---	Test Date: 10/24/11	Checked By:	jdt
Depth : ---	Test Id: 221006		

Percent Passing #200 Sieve - ASTM D 1140-00

Boring ID	Sample ID	Depth	Visual Description	Fines, %
---	CA-SAFL-SB01-0102	---	Moist, dark brown silty sand	38
---	CA-SAFL-SB01-0203	---	Moist, brownish yellow silty sand	32
---	CA-SAFL-SB01-0406	---	Moist, yellowish brown sand	3.6
---	CA-SAFL-SB01-0810	---	Moist, brownish yellow sand with gravel	1.8
---	CA-SAFL-SB01-1820	---	Moist, light brown sand	2.9
---	CA-SAFL-SB02-0103	---	Moist, olive yellow clayey sand	37.4
---	CA-SAFL-SB02-0304	---	Moist, brownish yellow sand with silt and gravel	8
---	CA-SAFL-SB02-0406	---	Moist, brownish yellow sand with silt	8.8
---	CA-SAFL-SB02-0810	---	Moist, light yellow sand	1.5
---	CA-SAFL-SB02-2325	---	Moist, light gray sand with gravel	1.7

Client:	Tetra Tech NUS, Inc.		
Project:	NWIRP Calverton Geotech		
Location:	Calverton, NY	Project No:	GTX-11233
Boring ID: ---	Sample Type: bag	Tested By:	jbr
Sample ID:CA-SAFL-SB01-0304	Test Date: 10/24/11	Checked By:	jdt
Depth : ---	Test Id: 221007		
Test Comment:	---		
Sample Description:	Moist, brownish yellow sand with silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	14.1	77.7	8.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	86		
#10	2.00	73		
#20	0.85	63		
#40	0.42	41		
#60	0.25	19		
#100	0.15	10		
#200	0.075	8		

Coefficients

D_{85} =4.4817 mm
D_{30} =0.3282 mm
D_{60} =0.7787 mm
D_{15} =0.1990 mm
D_{50} =0.5681 mm
D_{10} =0.1301 mm
C_u =5.985
C_c =1.063

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

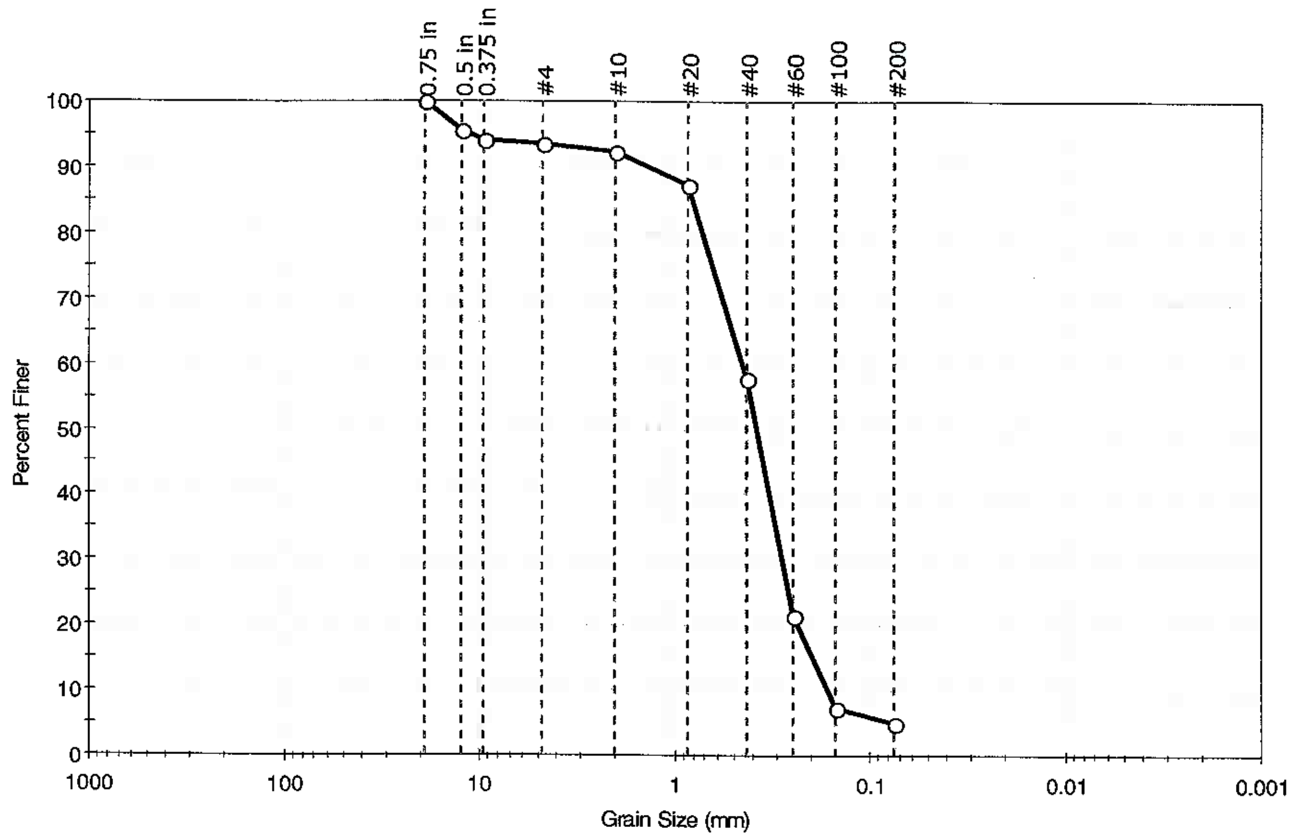
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

Client:	Tetra Tech NUS, Inc.		
Project:	NWIRP Calverton Geotech		
Location:	Calverton, NY	Project No:	GTX-11233
Boring ID: ---	Sample Type: bag	Tested By:	jbr
Sample ID:CA-SAFL-SB01-0608	Test Date: 10/24/11	Checked By:	jdt
Depth : ---	Test Id: 221008		

Test Comment: ---
Sample Description: Moist, yellowish brown sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	6.3	88.6	5.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	94		
#4	4.75	94		
#10	2.00	92		
#20	0.85	87		
#40	0.42	58		
#60	0.25	22		
#100	0.15	7		
#200	0.075	5		

Coefficients

D_{85} =0.8044 mm D_{30} =0.2825 mm
D_{60} =0.4466 mm D_{15} =0.1974 mm
D_{50} =0.3786 mm D_{10} =0.1654 mm
C_u =2.700 C_c =1.080

Classification

ASTM N/A

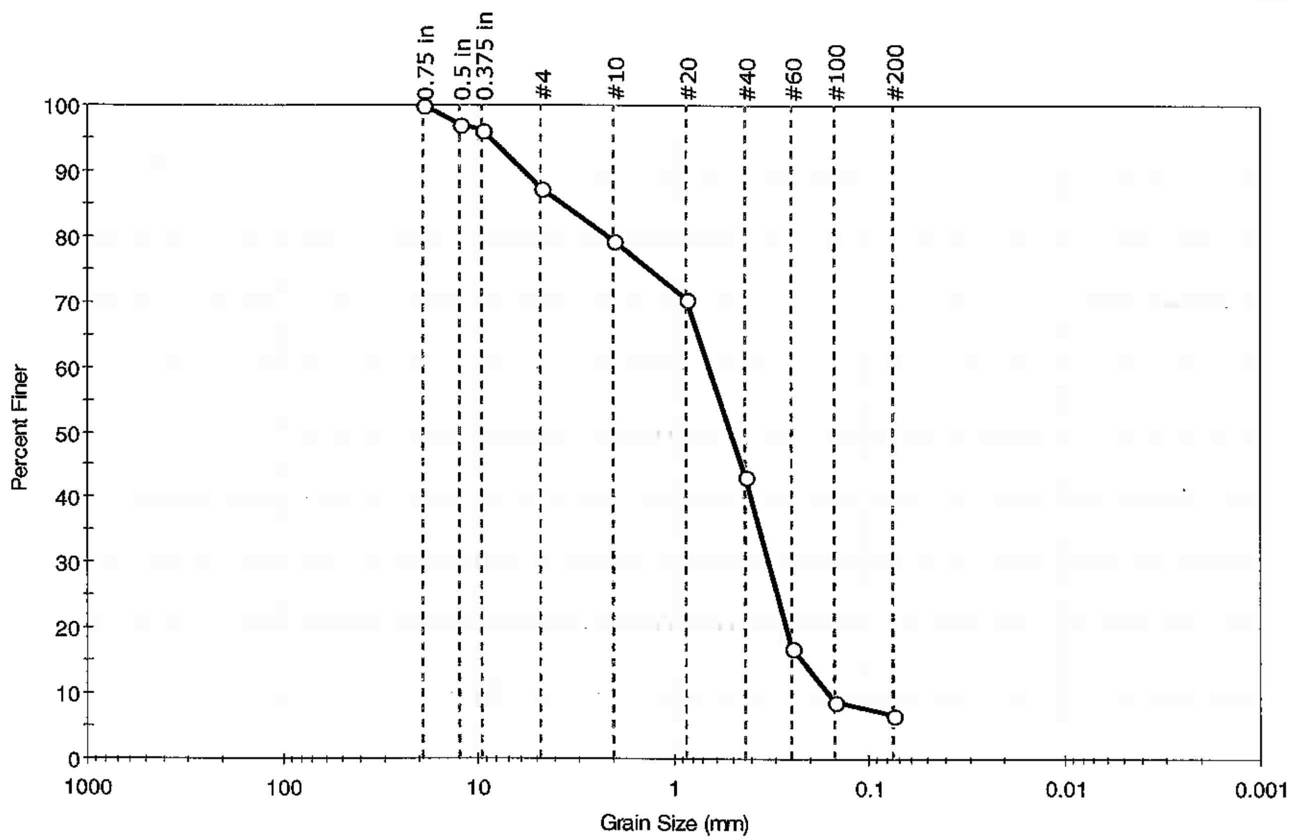
AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD

Client:	Tetra Tech NUS, Inc.			
Project:	NWIRP Calverton Geotech			
Location:	Calverton, NY		Project No:	GTX-11233
Boring ID: ---		Sample Type: bag	Tested By:	jbr
Sample ID:CA-SAFL-SB02-0608		Test Date: 10/24/11	Checked By:	jdt
Depth : ---		Test Id: 221009		
Test Comment:	---			
Sample Description:	Moist, brownish yellow sand with silt			
Sample Comment:	---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	12.7	80.6	6.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	97		
0.375 in	9.50	96		
#4	4.75	87		
#10	2.00	79		
#20	0.85	70		
#40	0.42	43		
#60	0.25	17		
#100	0.15	9		
#200	0.075	7		

Coefficients

D_{85} =3.7141 mm D_{30} =0.3240 mm

D_{60} =0.6510 mm D_{15} =0.2180 mm

D_{50} =0.5039 mm D_{10} =0.1605 mm

C_u =4.056 C_c =1.005

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

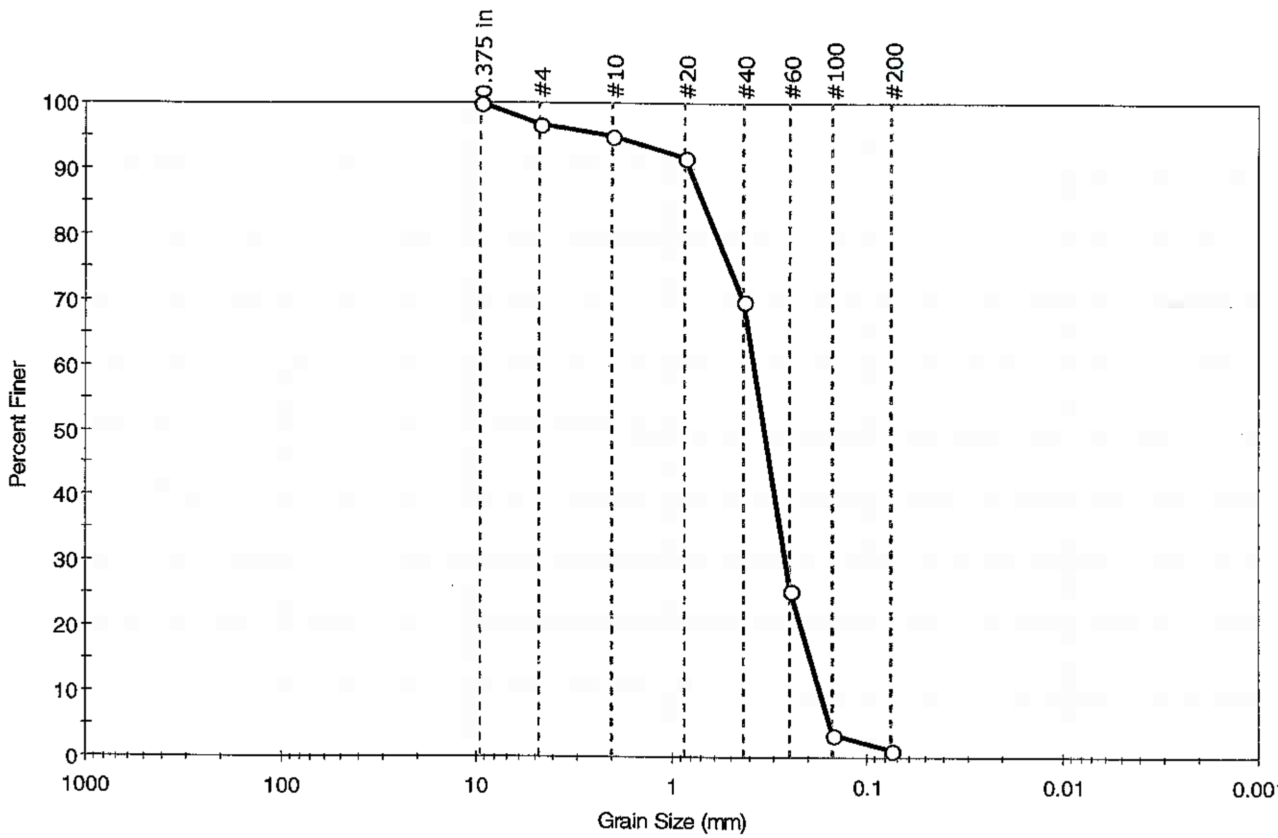
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Tetra Tech NUS, Inc.		
Project:	NWIRP Calverton Geotech		
Location:	Calverton, NY	Project No:	GTX-11233
Boring ID: ---	Sample Type: bag	Tested By:	jbr
Sample ID:CA-SAFL-SB02-1820	Test Date: 10/24/11	Checked By:	jdt
Depth : ---	Test Id: 221010		
Test Comment:	---		
Sample Description:	Moist, light yellowish brown sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	3.3	95.4	1.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	95		
#20	0.85	92		
#40	0.42	70		
#60	0.25	26		
#100	0.15	4		
#200	0.075	1		

Coefficients

D_{85} =0.6877 mm	D_{30} =0.2637 mm
D_{60} =0.3779 mm	D_{15} =0.1954 mm
D_{50} =0.3352 mm	D_{10} =0.1739 mm
C_u =2.173	C_c =1.058

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

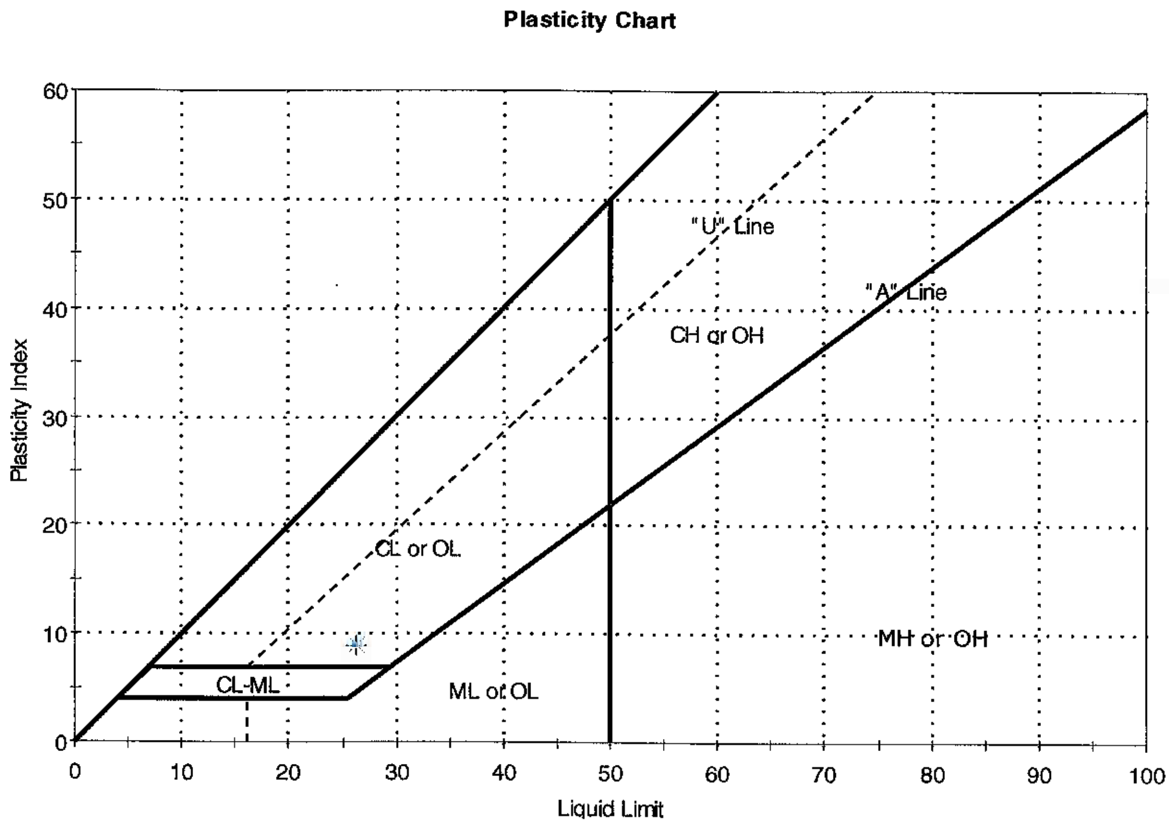
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Tetra Tech NUS, Inc.
Project:	NWIRP Calverton Geotech
Location:	Calverton, NY
Project No:	GTX-11233
Boring ID:	---
Sample Type:	bag
Tested By:	cam
Sample ID:	CA-SAFL- SB02-0103
Test Date:	10/26/11
Checked By:	jdt
Depth :	---
Test Id:	221011
Test Comment:	---
Sample Description:	Moist, olive yellow clayey sand
Sample Comment:	---

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	CA-SAFL-SB02-0103	---	---	14	26	17	9	0	

Sample Prepared using the WET method

Dry Strength: HIGH
Dilentancy: RAPID
Toughness: LOW

CHAIN OF COUSTODY

GeoTesting Express

GeoTesting Express, Inc.
125 Nagog Park
Acton, MA 01720
800-434-1062 Toll Free
978-635-0424 Phone
978-635-0266 Fax

Sales Order No.:
GTX No.:

Company Name: Tetra Tech NUS
Address: 5700 Lake Wright Dr, Suite 309 Norfolk, VA 23502
Contact: Robert Sok
E-mail: rob.sok@tetratech.com
Phone Number: 757-466-4904
Fax Number:
Project Name: NWIRP Calverton Geotech
Project Number: 112G02750
Project Location: Calverton, NY

Sample Type: 1. Soil 2. Geosynthetic 3. Rock 4. Concrete 5. Other

Container Type: 1. Bucket 2. Bag 3. Jar 4. Tube 5. Roll

Analysis

Sample Identification	Container Size	Container Type	Sampling Date	Sampling Time	Sample Type	Grain Size (sieve only) ASTM D422	moisture content (D2216)	% finer than No. 200 (D1140)	Atterberg Limits (D4318)			Comments
A-SAFL-SB01-0102	1gal	2	10/17	1215	1		X	X				
A-SAFL-SB01-0203	↓	↓	↓	1217	1		X	X				
A-SAFL-SB01-0304				1220	1	X	X					
A-SAFL-SB01-0406				1224	1		X	X				
A-SAFL-SB01-0608				1227	1	X	X					
A-SAFL-SB01-0810				1234	1		X	X				
A-SAFL-SB01-1820				1250	1		X	X				
A-SAFL-SB02-0163				1410	1		X	X	X			
A-SAFL-SB02-0304	↓	↓	↓	1412	1		X	X				

Relinquished By:	Date: 10/18/11 Time: 1600	Received By:	Date: 10/19/11 Time:	Turn-Around Time Requested:
Relinquished By:	Date: Time:	Received By:	Date: Time:	No. of Business Days: ________
Relinquished By:	Date: Time:	Received By:	Date: Time:	Special Instructions:

SHIPPED VIA:

CHAIN OF COSTODY

GeoTesting Express, Inc.
125 Nagog Park
Acton, MA 01720
800-434-1062 Toll Free
978-635-0424 Phone
978-635-0266 Fax

Sales Order No.:
GTX No.:

ompany Name: Tetra Tech NUS
ddress: 5700 Lakewright Dr., Suite 309 Norfolk, VA 23502
ontact: Robert Sok
mail: rob.sok@tetratech.com
hone Number: 757-466-4904
ax Number:
roject Name: NWIRP Calverton Geotech
roject Number: 112G02750
roject Location: Calverton, NY

Sample Type: 1. Soil, 2. Geosynthetic, 3. Rock, 4. Concrete, 5. Other

Container Type: 1. Bucket, 2. Bag, 3. Jar, 4. Tube, 5. Roll

Sample Identification	Container Size	Container Type	Sampling Date	Sampling Time	Sample Type	Grain Size (Sieve only)	Moisture	% finer than 200				Comments
-SAFL-SB02-0406	2 Gal	2	10/17	1416	1		X	X				
-SAFL-SB02-0608	↓	↓	↓	1418	1	X	X					
-SAFL-SB02-0810	↓	↓	↓	1422	1		X	X				
-SAFL-SB02-1820	↓	↓	↓	1440	1	X	X					
-SAFL-SB02-2325	↓	↓	↓	1455	1		X	X				

elinquished By:	Date: 10/18/11 Time: 1600	Received By:	Date: 10/19/11 Time:	**Turn-Around Time Requested:**	
elinquished By:	Date: Time:	Received By:	Date: Time:	No. of Business Days: ________	
elinquished By:	Date: Time:	Received By:	Date: Time:	**Special Instructions:**	

HIPPED VIA:

GeoTesting
EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

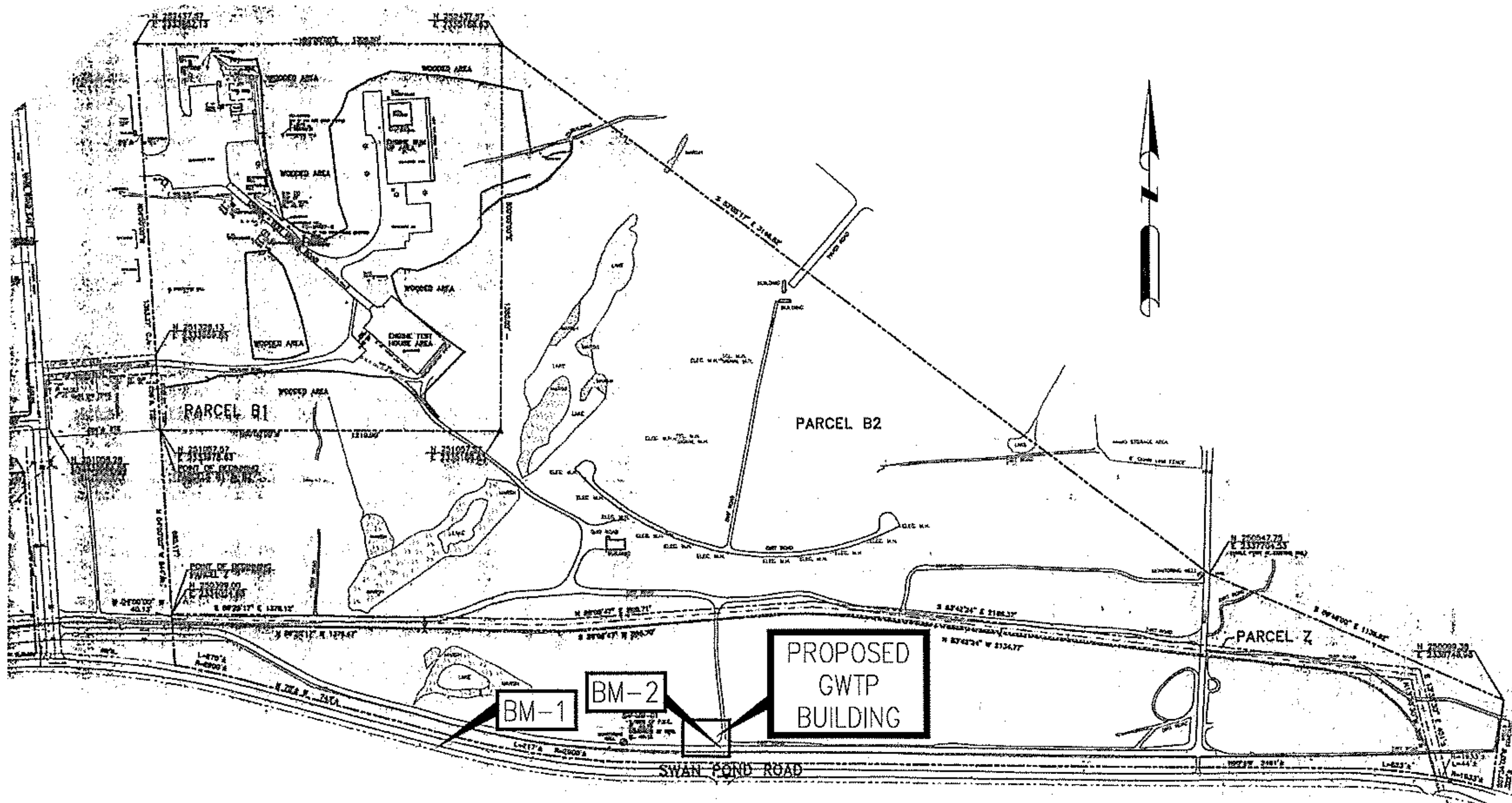
Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
PI	plasticity index
i	gradient
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S	degree of saturation
SL	shrinkage limit
s_u	undrained shear strength
T	time factor for consolidation

T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

Appendix E – Stamped Drawings

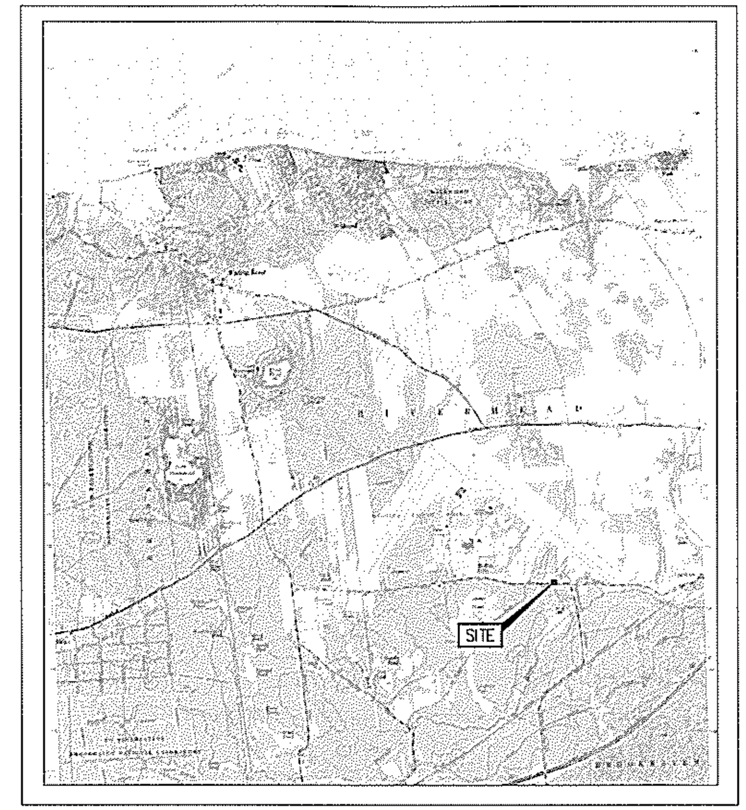
CALVERTON FENCELINE
GROUNDWATER TREATMENT FACILITY
GRUMMAN BOULEVARD
SUFFOLK COUNTY, NEW YORK



PROPERTY PLAN - 1"=300'

(BASED ON FUEL AREA CALIBRATION PLAN - SEE BOUNDARY & REFERENCE PLAN NOTES)

0 300 600 900



GENERAL VICINITY MAP - 1"=5000'

SOURCE: USGS - WADING RIVER, NY - 7.5 MINUTE QUADRANGLE - 1967

0 2500 5000 10000

1"=5000'

DRAWING LIST

GENERAL
- G-0 COVER SHEET
- G-1 GENERAL NOTES & LEGEND

CIVIL
- C-1 SITE LAYOUT PLAN
- C-2 SITE UTILITY PLAN
- C-3 SITE UTILITY OVERALL PLAN
- C-4 SITE GRADING PLAN
- C-5 EROSION & SEDIMENT CONTROL PLAN
- C-6 E&S CONTROL DETAILS
- C-7 SITE DETAILS

ARCHITECTURAL
- * A-0 CODE PLAN
- A-1 FLOOR PLAN
- A-2 ROOF PLAN AND BUILDING ELEVATIONS
- A-3 BUILDING SECTIONS
- A-4 SCHEDULES AND DETAILS

STRUCTURAL
- S-1 FOUNDATION PLAN
- S-2 FOUNDATION DETAILS
- S-3 STRUCTURAL DETAILS
- S-4 GENERAL NOTES, ABBREVIATIONS

PROCESS & MECHANICAL
- M-1 BUILDING EQUIPMENT LAYOUT
- M-2 MECHANICAL SECTION
- M-3 MECHANICAL DETAILS
- PFD PROCESS FLOW DIAGRAM
- PID-1 P&ID-1
- PID-2 P&ID-2
- PID-3 P&ID-3

ELECTRICAL
- E-1 ELECTRICAL SINGLE LINE DIAGRAM
- E-2 MCC-TB ELECTRICAL SINGLE LINE DIAGRAM
- E-3 MOTOR ELEMENTARY & RISER DIAGRAMS
- E-4 ELECTRICAL LIGHTING PLAN
- E-5 ELECTRICAL LIGHTING SCHEDULE & DETAILS
- E-6 ELECTRICAL GROUNDING PLAN
- E-7 ELECTRICAL- GROUNDING NOTES AND DETAILS
- E-8 FCP-1 ELEMENTARY DIAGRAM-SHEET 1
- E-9 FCP-1 ELEMENTARY DIAGRAM-SHEET 2

* - NOT INCLUDED IN THIS 100% SUBMISSION

SITE DATA:

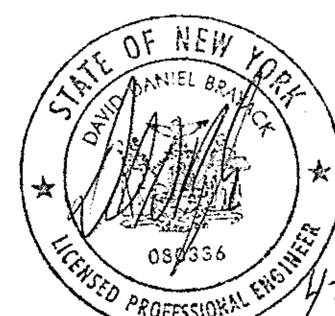
1. PREPARED FOR: UNITED STATES NAVY
2. OWNER: UNITED STATES OF AMERICA
3. PROPERTY ADDRESS: 3466 RIVER ROAD
   CALVERTON, N.Y. 11933
   TOWN OF RIVERHEAD, SUFFOLK COUNTY, NEW YORK
4. TAX PARCEL NUMBER: 0600-135.00-01.00-007-002 (PARCELS B1, B2, AND Z)
5. SOURCE OF TITLE: TAX PARCEL MAP BOOK 12043, PAGES 576
6. PARCEL AREA: 168.90± ACRES (PER PARCEL RECORD)
7. ZONING: PLANNED RECREATIONAL PARK DISTRICT (PRP).
8. TOPOGRAPHY: TOPOGRAPHY IS BASED ON A FIELD SURVEY PERFORMED BY TETRA TECH ON AUGUST 9-10, 2011, RAB & AN.
9. DATUM: HORIZ. & VERT.: NY STATE PLANE LONG ISLAND, NAD83/NAVD88, FEET
10. BENCHMARK:

DESC:	NORTH	EAST	ELEV
BM-1 (I.P. @ PP#85)	271365.0187	1319529.1029	43.98
BM-2 (PK @ PERIMETER RD)	271407.2791	1320353.9814	-

BM'S ARE REFERENCED TO DISK Q334 (LOCATED ON SOUND AVE NEAR PP# 681).

11. BOUNDARY. BOUNDARY LINES, INCLUDING THE SWAN POND ROAD RIGHT-OF-WAY, ARE BASED ON THE FUEL CALIBRATION AREA PLAN (REFERENCED BELOW). THE BOUNDARY SHOWN WAS TIED TO THE FIELD SURVEY VIA CONTROL COORDINATES LISTED ON THE PLAN (TRANSFERRED FROM NAD27 TO NAD83). ADDITIONALLY, UNVERIFIED DIFFERING RIGHT-OF-WAY LINES WERE TRACED FROM THE WATER MAIN INSTALLATION PLAN (ALSO REFERENCED BELOW). HOWEVER, THE RIGHT-OF-WAY TAKING SHOWN ON THAT PLAN, INCLUDING ITS PRECISE LOCATION, HAS NOT BEEN CONFIRMED AT THIS TIME. NO PROPERTY MARKERS WERE FOUND DURING THE FIELD SURVEY.
12. UTILITIES: UTILITIES ARE SHOWN ACCORDING TO FIELD SURVEYED FOUND SURFACE EVIDENCE AND BEST AVAILABLE PLANS. ALL UTILITIES ARE APPROXIMATE AND MUST BE VERIFIED PRIOR TO COMMENCING EXCAVATION OPERATIONS.
13. NATURAL RESOURCES THIS SITE IS LOCATED IN THE GROUNDWATER CLASS ZONE III. FRESHWATER WETLANDS ARE LOCATED ON THIS PARCEL.
14. REFERENCE PLANS: "FUEL CALIBRATION AREA PLAN - PARCELS B1, B2, & Z," UNITED STATES OF AMERICA, DEPARTMENT OF THE NAVY, NAVAL WEAPONS INDUSTRIAL RESERVE PLANT, CALVERTON, SUFFOLK COUNTY, NEW YORK, PREPARED BY L. K. McLEAN ASSOCIATES, P.C., DATED AUGUST 23, 1996 AND LAST REVISED MAY 1998.

    "INSTALLATION OF WATER MAINS & APPURTENANCES, EXTENSION NO. 89, PECONIC RIVER SPORTSMAN'S CLUB," RDWD 10-53, RIVERHEAD WATER DISTRICT, TOWN OF RIVERHEAD, SUFFOLK COUNTY, NEW YORK, PREPARED BY H2M ENGINEERS, DATED MARCH 2011.



4-30-12

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

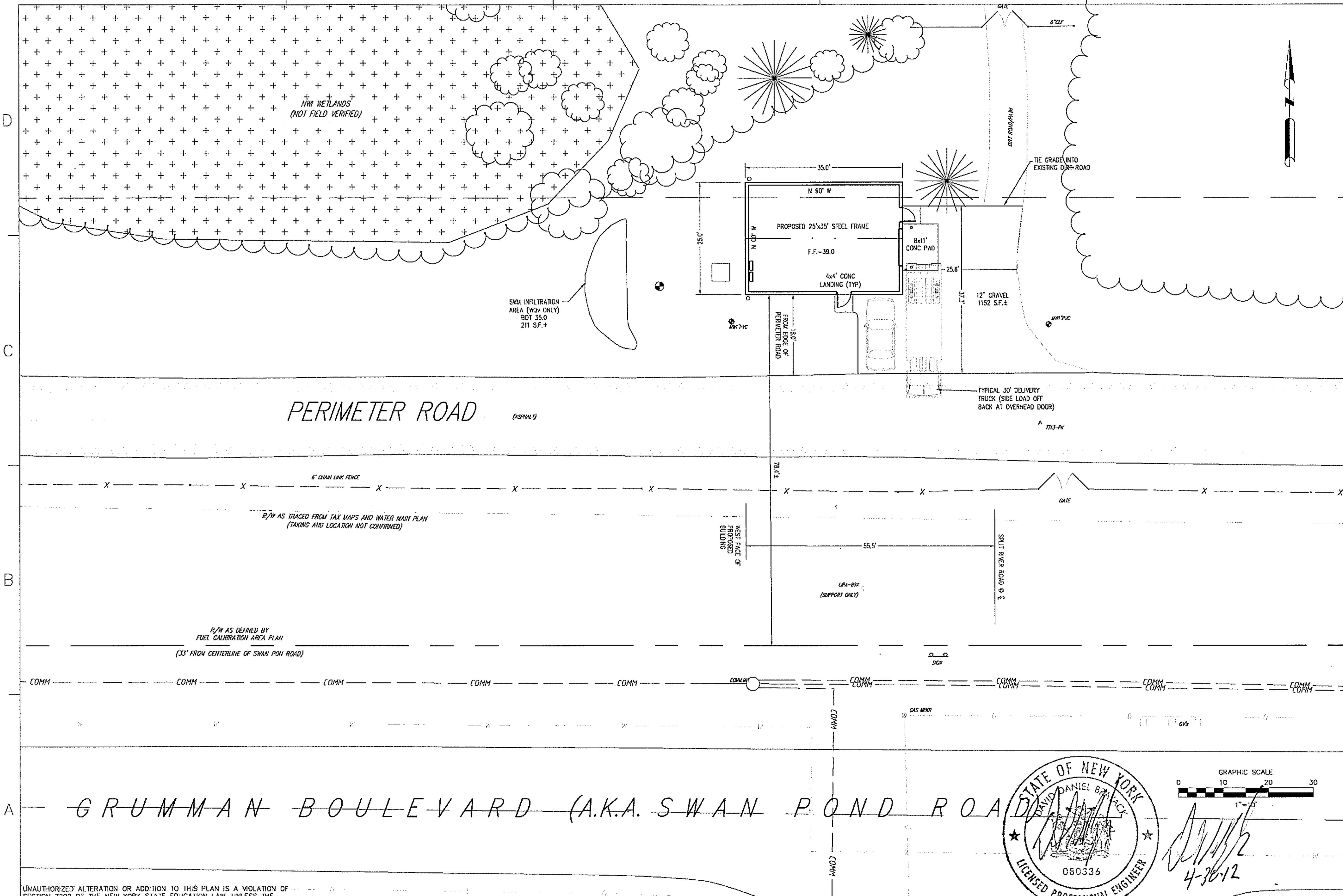
NAVFAC

DES YL / CSG	DR YL	
REVIEWED BY	CSG	
PM/DM	DDB	
CHIEF ENG/ARCH	CSG	

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT NAVAL STATION - NORFOLK, VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK
CALVERTON FENCELINE
GROUNDWATER TREATMENT PLANT
COVER SHEET

CODE ID. NO. 80091	SIZE D
SCALE:	AS NOTED
MAXIMO NO.	XXX
JOB ORDER NO.	XXX
SPEC. NO.	
CONSTR. CONTR. NO. 112G02750	
NAVFAC DRAWING NO.	
SHEET OF	
G-0	

K:\112G02750 - Navy Calverton Fenceline GWTP - HKM\Drawings\G-0-CoverSheet.dwg 04/24/2012 15:05



UNAUTHORIZED ALTERATION OR ADDITION TO THIS PLAN IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW, UNLESS THE PERSON IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ANY PLAN ALTERATIONS BY ANOTHER ENGINEER MUST BE MARKED AS SUCH, INCLUDING THE SIGNATURE AND SEAL OF THE ALTERING ENGINEER.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

DES YL/CSG	DR YL
REVIEWED BY	CSG
PM/DM	DDB
CHIEF ENG/ARCH	CSG

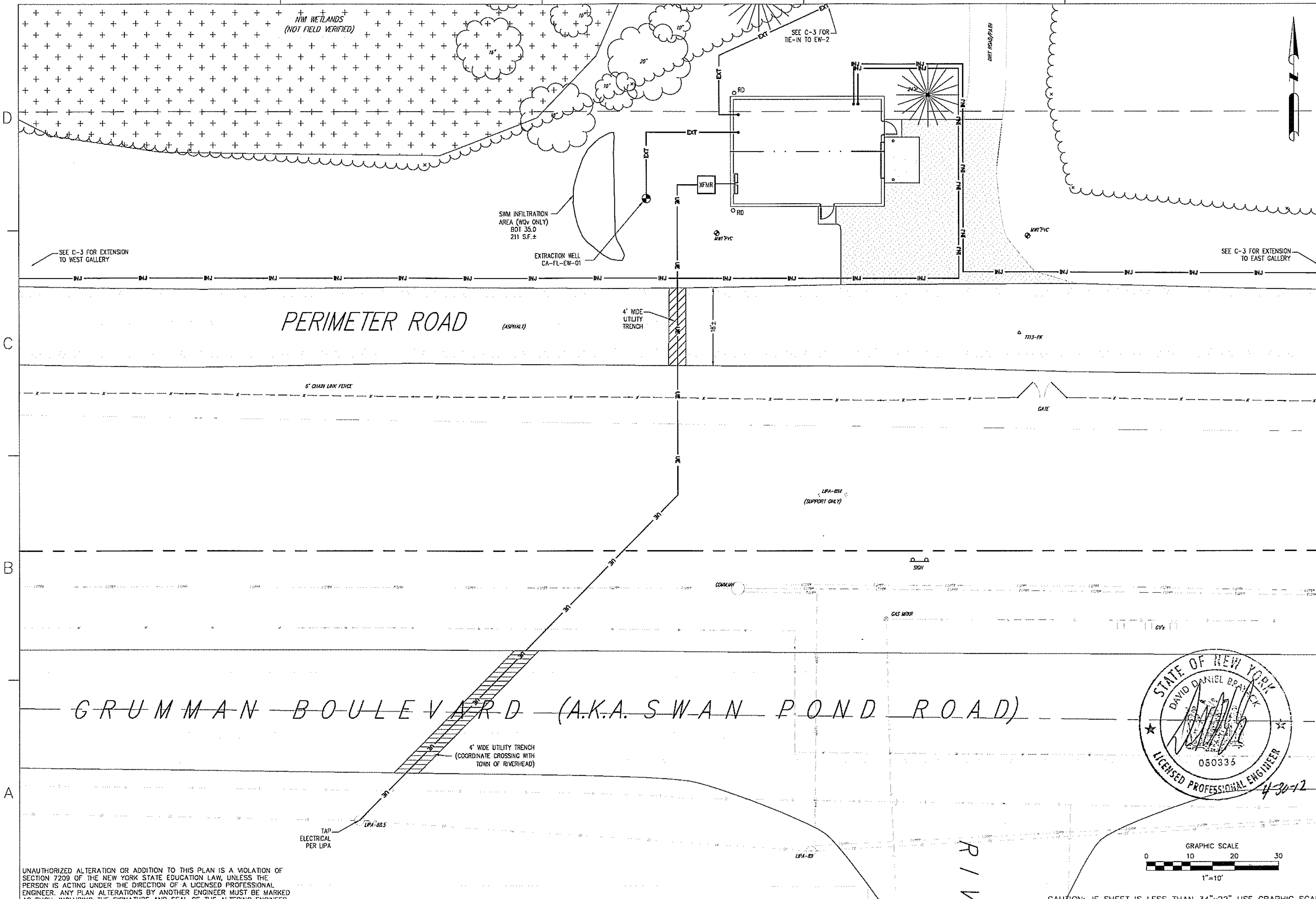
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT — NAVAL STATION - NORFOLK, VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK

CALVERTON FENCELINE GROUNDWATER TREATMENT PLANT

SITE LAYOUT PLAN

CODE ID. NO. 80091	SIZE D
SCALE:	1"=10'
MARMO NO	XXX
JOB ORDER NO	XXX
SPEC. NO	
CONSTR. CONTR. NO. 112G02750	
NAVFAC DRAWING NO.	
SHEET OF	
C-1	

K:\112G02750 – Navy Calverton Fenceline GWTP – HKM\Drawings\Civil\C-1-SitePlan.dwg 04/24/2012 15:27



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CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

DES YL/CSG | DR YL
REVIEWED BY CSG
PM/DM DDB
CHIEF ENG/ARCH CSG

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT — NAVAL STATION - NORFOLK, VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK

CALVERTON FENCELINE GROUNDWATER TREATMENT PLANT

SITE UTILITY PLAN

CODE ID. NO. 80091 | SIZE D
SCALE: 1"=10'
MAKMO NO XXX
JOB ORDER NO XXX
SPEC. NO
CONSTR. CONTR. NO. 112G02750
NAVFAC DRAWING NO.
SHEET OF
C-2

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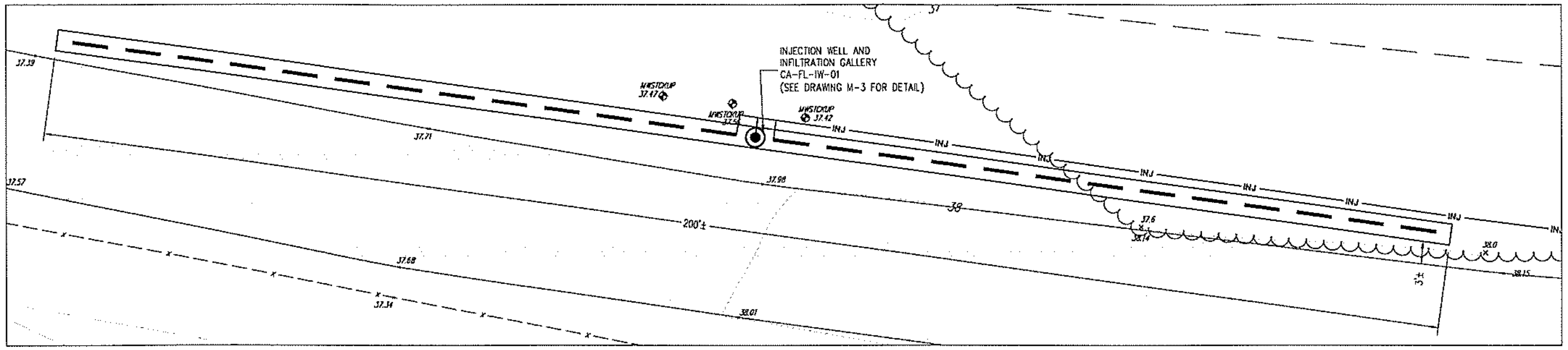
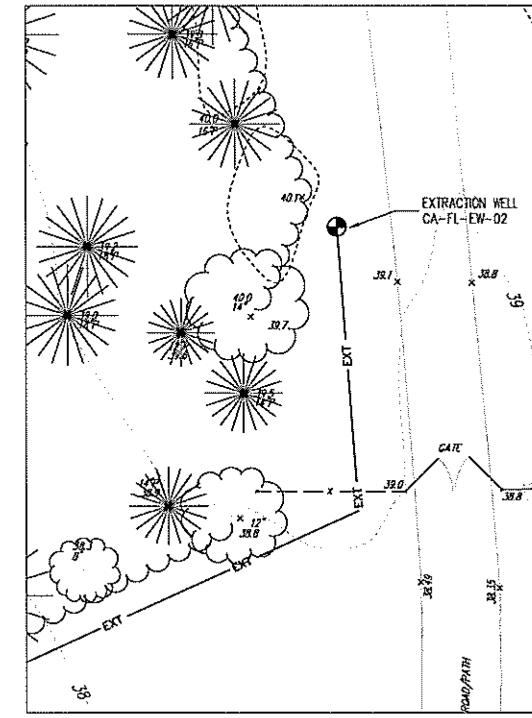
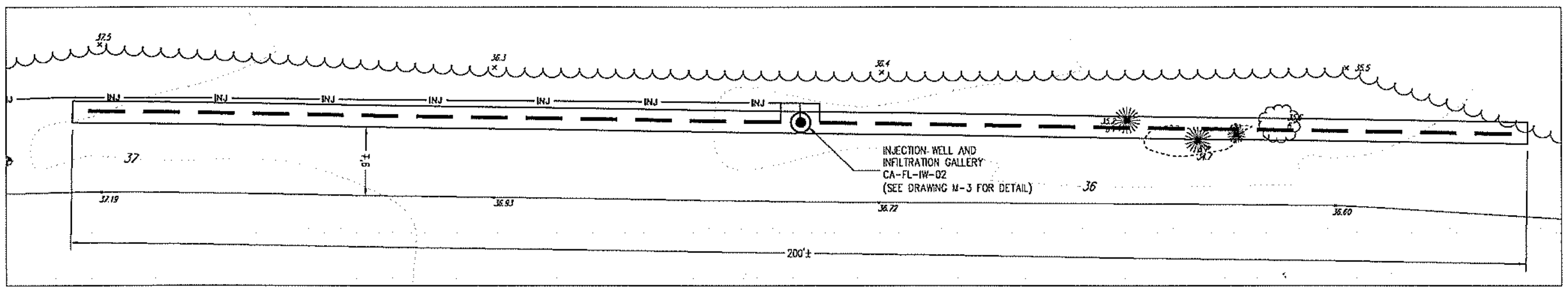


A PLAN **WEST GALLERY**
C-3 1"=10'

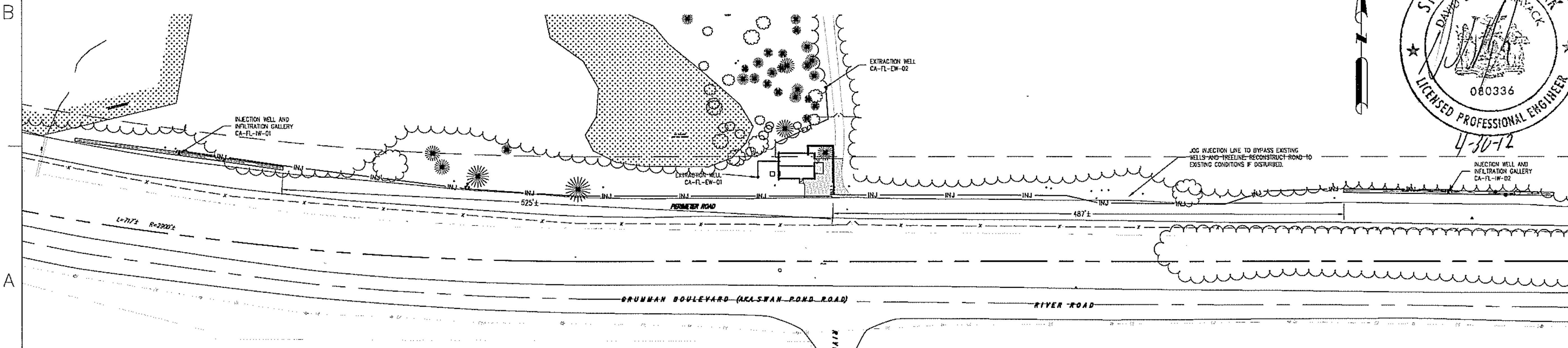
GRAPHIC SCALE
0 10 20 30
1"=10'



D PLAN **EW-2 TIE-IN**
C-3 1"=10'



B PLAN **EAST GALLERY**
C-3 1"=10'



C PLAN **OVERALL INJECTION SYSTEM**
C-3 1"=50'

GRAPHIC SCALE
0 50 100 150
1"=50'

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STATE OF NEW YORK
DAVID DANIEL BRAYACK
080336
LICENSED PROFESSIONAL ENGINEER
4-30-12

ISSUED FOR BIDDING | DESCRIPTION | DATE | APPR

NAVFAC

DES YL/CSG | DR YL
REVIEWED BY CSG
PM/DM CSG
CHIEF ENG/ARCH CSG

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST PT NAVAL STATION - NORFOLK VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK
CALVERTON FENCELINE
GROUNDWATER TREATMENT PLANT
INFILTRATION GALLERY PLAN

CODE ID. NO. 80091	SIZE D
SCALE	AS NOTED
NAVFAC NO.	XXX
JOB ORDER NO.	XXX
SPEC. NO.	
CONSTR. CONTR. NO.	112G02750
NAVFAC DRAWING NO.	
SHEET	OF
C-3	

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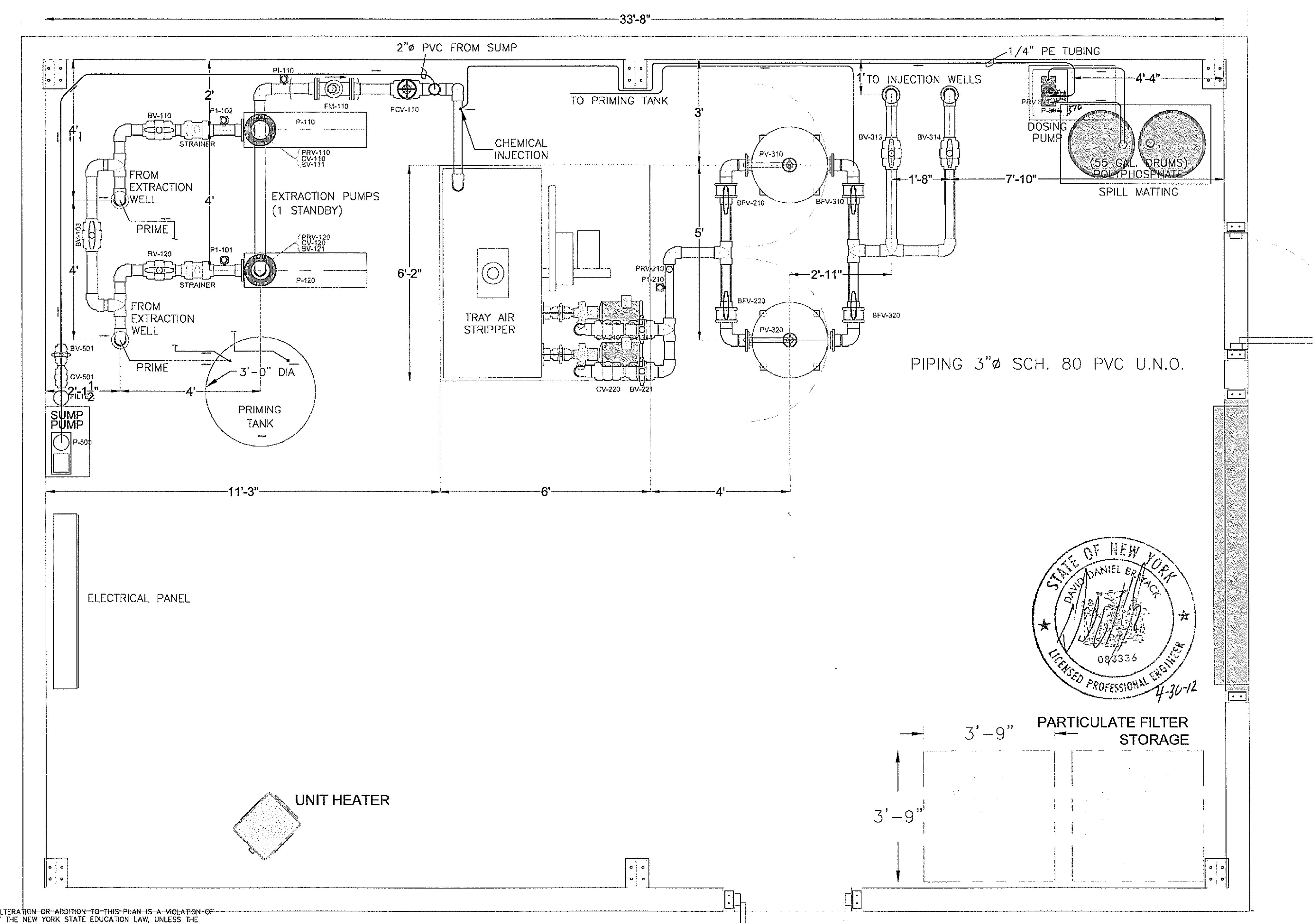

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ISSUED FOR BIDDING

NAVFAC

Tt

DES SK	DR SHL
REVIEWED BY	SK
PM/DM	DCB
CHIEF ENG/ARCH	SK

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT NAVAL STATION - NORFOLK, VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK

CALVERTON FENCELINE GROUNDWATER TREATMENT PLANT

BUILDING LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE:	
WAZMO NO	
JOB ORDER NO	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02750	
NAVFAC DRAWING NO.	
SHEET OF	
M-1	

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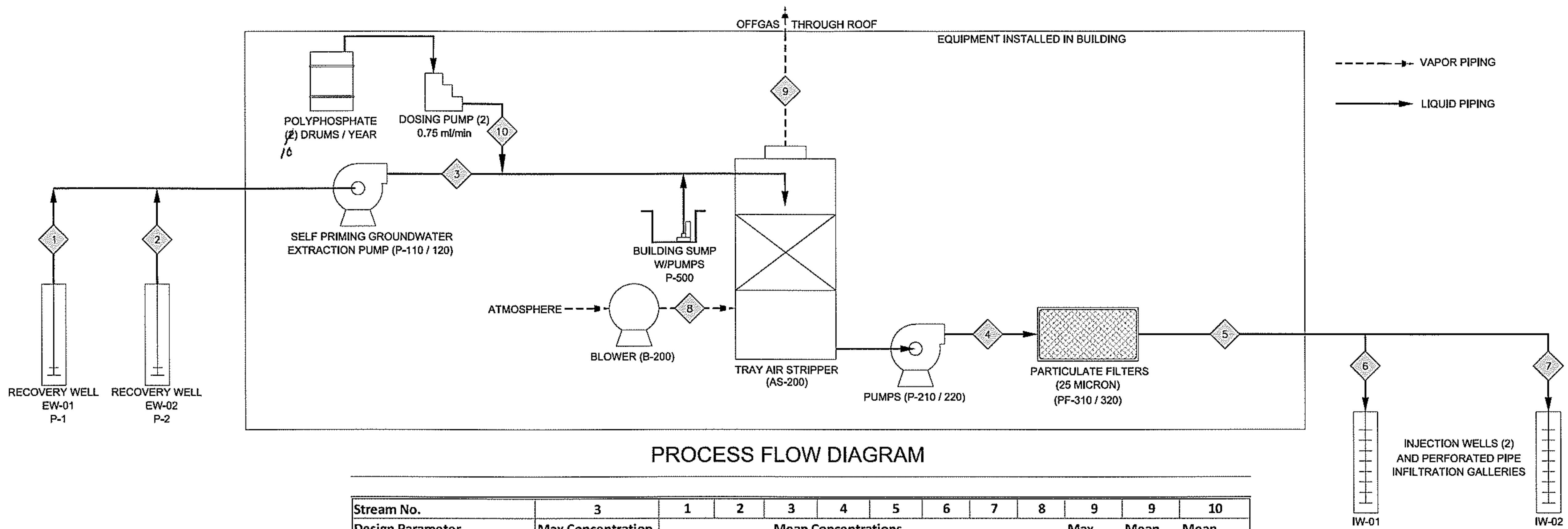

PROCESS FLOW DIAGRAM

Stream No.	3	1	2	3	4	5	6	7	8	9	9	10
Design Parameter	Max Concentration	Mean Concentrations								Max	Mean	Mean
Medium	Water	Water	Water	Water	Water	Water	Water	Water	Air	Air (ppmv)	Air (ppmv)	Poly-phosphate
Maximum Flow rate, gpm	140	70	70	140	140	140	70	70	---	---	---	---
Average Flow rate, gpm	100	50	50	100	100	100	50	50				
Temperature, C	11	11	11	11	11	11	11	11	---	---	---	---
pH	6	6	6	6	7.5	7.5	7.5	7.5	---	---	---	---
Fe(II), ug/l	2,400	1,200	1,200	1,200	---	---	---	---	---	---	---	---
Fe (III) ug/l	---	---	---	---	1,200	300	300	300	---	---	---	---
Iron Total, ug/l	2,400	1,200	1,200	1,200	1,200	300	300	300	---	---	---	---
Mn(II), ug/l	3,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	---	---	---	---
Mn Total, ug/l	3,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	---	---	---	---
1,1,1-Trichloroethane, ug/l	260	11	11	11	<1	<1	<1	<1	---	0.97	0.029	---
1,1-Dichloroethane, ug/l	1,100	51	51	51	<1	<1	<1	<1	---	5.52	0.182	---
1,1-Dichloroethene, ug/l	65	2.5	2.5	2.5	<1	<1	<1	<1	---	0.33	0.009	---
Chloroethane, ug/l	320	13	13	13	<1	<1	<1	<1	---	2.46	0.070	---
Benzene, ug/l	4.4	0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	---	0.03	0.001	---
1,4-Dichlorobenzene, ug/l	16	1	1	1	<1	<1	<1	<1	---	0.05	0.002	---
1,3-Dichlorobenzene, ug/l	4	0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	---	0.01	0.000	---
1,2-Dichlorobenzene, ug/l	6.4	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3	---	0.02	0.001	---
Isopropyl Benzene, ug/l	11	0.4	0.4	0.4	<0.4	<0.4	<0.4	<0.4	---	0.05	0.001	---
1,2,4-Trichlorobenzene, ug/l	14	1	1	1	<1	<1	<1	<1	---	0.04	0.001	---
Total Target VOC, ug/l	**1,801**	**80**	**80**	**80**	**<5**	**<5**	**<5**	**<5**	---	---	---	---
Air Flow Rate, CFM		---	---	---	---	---	---	---	900	900	900	---
Total Vapor VOC, Pounds/day		---	---	---	---	---	---	---	0	2.159	0.096	---
Air Temperature; F		---	---	---	---	---	---	---	50	50	50	---
Polyphosphate; dose (mg/l) & flow (GPD)		---	---	---	---	---	---	---	---	---	---	2 mg/l; ~~3.7~~ GPD 1.4

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STATE OF NEW YORK
DAVID DANIEL
080336
LICENSED PROFESSIONAL ENGINEER

4-30-12

NAVFAC

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NAVAL STATION - NORFOLK, VIRGINIA
GRUMMAN RD CALVERTON NY SUFFOLK COUNTY, NEW YORK
CALVERTON FENCELINE
GROUNDWATER TREATMENT PLANT
PROCESS FLOW DIAGRAM

CONSTR. CONTR. NO. 112G02750

PFD